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(54) **Title:** ENGINEERED AMYLASE VARIANTS

(57) **Abstract:** The present invention provides engineered amylase polypeptides and compositions thereof. The engineered amylase polypeptides have been optimized to provide improved thermostability, protease stability, and stability under a range of pH conditions, including acidic (pH is less than 7) conditions. The invention also relates to the use of the compositions comprising the engineered amylase polypeptides for therapeutic and/or nutritional purposes. The present invention also provides polynucleotides encoding the engineered amylase polypeptides, as well as methods for making the engineered polynucleotides and amylase polypeptides.

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ENGINEERED AMYLASE VARIANTS

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims the benefit under 35 U.S.C. §119(e) of U.S. provisional application no. 63/071,641, filed August 28, 2020, the entire contents of which is incorporated herein by reference.

FIELD OF THE INVENTION

[0002] The present invention provides engineered amylase polypeptides and compositions thereof. The engineered amylase polypeptides have been optimized to provide improved thermostability, protease stability, and stability under a range of pH conditions, including acidic (pH <7) conditions. The invention also relates to the use of the compositions comprising the engineered amylase polypeptides for therapeutic and/or nutritional purposes. The present invention also provides polynucleotides encoding the engineered amylase polypeptides, as well as methods for making the engineered polynucleotides and amylase polypeptides.

REFERENCE TO SEQUENCE LISTING, TABLE OR COMPUTER PROGRAM

[0003] The official copy of the Sequence Listing is submitted concurrently with the specification as an ASCII formatted text file via EFS-Web, with a file name of "CX7-211WO2_ST25.txt", a creation date of August 27, 2021, and a size of 5.61 megabytes. The Sequence Listing filed via EFS-Web is part of the specification and is incorporated in its entirety by reference herein.

BACKGROUND OF THE INVENTION

[0004] Pancreatic enzyme replacement therapy (PERT) finds use in the treatment of pancreatic enzyme insufficiency (PEI). Various disorders, including pancreatitis, cystic fibrosis, celiac disease, inflammatory bowel disease, and pancreatic cancer can lead to PEI, as a consequence of decreased secretion of pancreatic enzymes into the duodenum. This results in poor digestion of food, inadequate absorption of fat, proteins, carbohydrates, and vitamins by the intestines, which can lead to malnutrition. Although orally administered PERT treatments are currently available, the condition may not be alleviated in some people, due to insufficient activity of the PERT in the gastrointestinal tract and/or insufficient patient compliance with the therapy due to the significant pill burden associated with current treatment protocols. In some cases, the coefficient of fat absorption (CFA) and/or coefficient of nitrogen absorption (CNA) is inferior to that of healthy patients, resulting in weight loss and other health concerns. Thus, a need remains in the art for improved PERT treatments.

SUMMARY OF THE INVENTION

[0005] The present invention provides engineered amylase polypeptides and compositions thereof. The engineered amylase polypeptides have been optimized to provide improved thermostability, protease stability, and stability under a range of pH conditions, including acidic (pH <7) conditions. The invention also relates to the use of the compositions comprising the engineered amylase polypeptides for therapeutic and/or nutritional purposes. The present invention also provides polynucleotides encoding the engineered amylase polypeptides, as well as methods for making the engineered polynucleotides and amylase polypeptides.

[0006] The present invention provide recombinant amylases and/or biologically active recombinant amylase fragments comprising amino acid sequences comprising at least about 70%, at least about 75%, at least about 80%, at least about 85%, at least about 90%, at least about 91%, at least about 92%, at least about 93%, at least about 94%, at least about 95%, at least about 96%, at least about 97%, at least about 98%, or at least about 99% sequence identity to SEQ ID NO: 2. In some embodiments, the recombinant amylase and/or biologically active recombinant amylase fragment comprises a polypeptide sequence having at least about 70%, about 75%, about 76%, about 77%, about 78%, about 79%, about 80%, about 81%, about 82%, about 83%, about 84%, about 85%, about 86%, about 87%, about 88%, about 89%, about 90%, about 91%, about 92%, about 93%, about 94%, about 95%, about 96%, about 97%, about 98%, about 99%, or more sequence identity to SEQ ID NO: 2, 18, 40, 156, 174, 276, 308, 422, 456, 546, 632, 664, 780, 988, 1104, 1122, 1224, 1256, 1370, 1404, 1494, 1580, 1612, and/or 1728.

[0007] The present invention provide recombinant amylases and/or biologically active recombinant amylase fragments comprising amino acid sequences comprising at least 70%, at least 75%, at least 80%, at least 85%, at least 90%, at least 91%, at least 92%, at least 93%, at least 94%, at least 95%, at least 96%, at least 97%, at least 98%, or at least 99% sequence identity to SEQ ID NO: 2. In some embodiments, the recombinant amylase and/or biologically active recombinant amylase fragment comprises a polypeptide sequence having at least 70%, 75%, 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99%, or more sequence identity to SEQ ID NO: 18, 40, 156, 174, 276, 308, 422, 456, 546, 632, 664, 780, 988, 1104, 1122, 1224, 1256, 1370, 1404, 1494, 1580, 1612, and/or 1728.

[0008] In some embodiments, the recombinant amylase comprises a polypeptide sequence having at least 70%, 75%, 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99%, or more sequence identity to SEQ ID NO: 2 or 18, or a functional fragment thereof, and wherein the recombinant amylase comprises one or more substitutions at positions selected from 2, 6, 16, 18, 19, 24, 26, 27, 29, 31, 33, 37, 38, 39, 41, 45, 48, 49, 51, 52, 58, 61, 66, 72, 73, 74, 81, 82, 91, 92, 94, 95, 98, 103, 111, 112, 114, 122, 123, 124, 126, 127, 128, 129, 130, 131, 132, 134, 137, 140,

141, 145, 149, 157, 158, 165, 166, 167, 170, 171, 172, 178, 180, 183, 184, 189, 194, 203, 204, 205, 206, 210, 214, 216, 220, 221, 223, 224, 225, 226, 227, 228, 246, 250, 252, 253, 254, 255, 256, 257, 258, 259, 268, 269, 270, 272, 275, 276, 279, 280, 282, 284, 285, 286, 294, 295, 298, 301, 302, 304, 305, 306, 308, 309, 310, 313, 315, 317, 319, 322, 324, 331, 338S, 345, 346, 349, 359, 360, 366, 371, 374, 380, 383, 384, 385, 387, 388, 392, 393, 394, 396, 397, 409, 411, 412, 413, 415, 417, 420, 423, 428, 429, 431, 437L 441, 442, 444, 446, 448, 451, 455, 458, 459, 463, 464, 466, 467, 468, 469, 470, 473, 474, 480, 481, 482, 483, 491, 492, 493, 494, and 495, wherein the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 2 or 18.

[0009] In some additional embodiments, the recombinant amylase comprises a polypeptide sequence having at least 70%, 75%, 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99%, or more sequence identity to SEQ ID NO: 2 or 18, or a functional fragment thereof, and wherein the recombinant amylase comprises one or more substitutions at positions selected from 16, 26, 29, 33, 91, 114,157, 158, 180, 184, 214, 223, 256, 272, 298, 302, 371, 380, 383, 394 412, 428, and 437, wherein the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 2 or 18.

[0010] In some additional embodiments, the recombinant amylase comprises a polypeptide sequence having at least 70%, 75%, 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99%, or more sequence identity to SEQ ID NO: 2 or 18, or a functional fragment thereof, and wherein the recombinant amylase comprises one or more substitutions selected from 16D, 26A, 29G, 29R, 29S, 29A, 29E, 33E, 91H, 114H, 157Y, 158R, 180E, 180Q, 184D, 184K, 214G, 223L, 256T, 272G, 272K, 272P, 272R, 272S, 298H, 302Q, 302G, 302H, 302R, 302V, 302W, 371F, 380R, 383E, 383I, 394N, 394S, 394G, 412A, 412L, 412D, 412S, 428T, and 437L, wherein the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 2 or 18.

[0011] In some additional embodiments, the recombinant amylase comprises a polypeptide sequence having at least 70%, 75%, 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99%, or more sequence identity to SEQ ID NO: 2 or 18, or a functional fragment thereof, and wherein the recombinant amylase comprises at least one substitution or substitution set at one or more positions selected from 2/73/256/493, 16/33/73/130/256/282/371/374/493, 16/33/130/256/302/371/383/470, 16/33/157/256/302/371/383, 16/73/74/256/282/366/371/383/493, 16/73/256/282/302/331/371/383, 16/130/256/276/374/470, 16/256/302/374, 19/72/345/473, 26/27/396/412/428/473, 26/27/412, 26/27/466/473, 29, 73/130/256/282/302/493, 74/371/374/383/493, 130/256/493, 149, 158, 254, 256, 256/383, 257, 259, 272, 279, 284, 317/383, 322, 345/388/396/428, 388/396/412/428, 396/412, 396/412/428/466, 409, 412, and 495, wherein the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 2 or 18. In some further embodiments, the recombinant amylase comprises a polypeptide sequence having at least 70%, 75%, 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99%, or more

sequence identity to SEQ ID NO: 2 or 18, or a functional fragment thereof, and wherein the recombinant amylase comprises at least one substitution or substitution set selected from 2K/73V/256S/493D, 16D/33E/73V/130D/256S/282D/371F/374S/493D, 16D/33E/130D/256S/302Q/371F/383E/470T, 16D/33E/157Y/256S/302Q/371F/383E, 16D/73V/74A/256S/282D/366L/371F/383E/493D, 16D/73V/256S/282D/302Q/331P/371F/383E, 16D/130D/256S/276Q/374S/470T, 16D/256S/302Q/374S, 19E/72T/345A/473D, 26A/27L/396H/412D/428E/473D, 26A/27L/412D, 26A/27L/466E/473D, 29G, 29R, 29S, 73V/130D/256S/282D/302Q/493D, 74A/371F/374S/383E/493D, 130D/256S/493D, 149R, 149T, 158R, 254G, 254S, 256S, 256S/383E, 257E, 257G, 257R, 257S, 257V, 259Q, 272G, 272K, 272P, 272R, 272S, 279R, 284C, 284R, 284S, 284Y, 317G/383L, 322A, 345A/388E/396H/428E, 388E/396H/412D/428E, 396H/412D, 396H/412D/428E/466E, 409S, 412S, 495E, 495L, and 495Y, wherein the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 2 or 18. In some further embodiments, the recombinant amylase comprises a polypeptide sequence having at least 70%, 75%, 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99%, or more sequence identity to SEQ ID NO: 2 or 18, or a functional fragment thereof, and wherein the recombinant amylase comprises at least one substitution or substitution set selected from R2K/I73V/A256S/E493D, E16D/D33E/I73V/E130D/A256S/E282D/Y371F/H374S/E493D, E16D/D33E/E130D/A256S/M302Q/Y371F/Q383E/V470T, E16D/D33E/F157Y/A256S/M302Q/Y371F/Q383E, E16D/I73V/P74A/A256S/E282D/F366L/Y371F/Q383E/E493D, E16D/I73V/A256S/E282D/M302Q/H331P/Y371F/Q383E, E16D/E130D/A256S/T276Q/H374S/V470T, E16D/A256S/M302Q/H374S, K19E/S72T/P345A/E473D, E26A/R27L/D396H/L412D/D428E/E473D, E26A/R27L/L412D, E26A/R27L/Q466E/E473D, D29G, D29R, D29S, I73V/E130D/A256S/E282D/M302Q/E493D, P74A/Y371F/H374S/Q383E/E493D, E130D/A256S/E493D, Q149R, Q149T, K158R, E254G, E254S, A256S, A256S/Q383E, P257E, P257G, P257R, P257S, P257V, P259Q, D272G, D272K, D272P, ddD272R, D272S, D279R, K284C, K284R, K284S, K284Y, V317G/Q383L, F322A, P345A/D388E/D396H/D428E, D388E/D396H/L412D/D428E, D396H/L412D, D396H/L412D/D428E/Q466E, V409S, L412S, I495E, I495L, and I495Y, wherein the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 2 or 18.

[0012] In some additional embodiments, the recombinant amylase comprises a polypeptide sequence having at least 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99%, or more sequence identity to SEQ ID NO: 40 or 988, or a functional fragment thereof, and wherein the recombinant amylase comprises at least one substitution or substitution set at one or more positions selected from 26/29/158/272/412, 26/29/272/279/412/493, 26/29/272/396/412,

26/29/279/412/428, 26/158/272/279/388/412/428, 26/158/272/412, 26/272/279/412/428/493, 29/272/279/396/412, 130/149/254/284/322/409/495, 130/149/257/284/322/409/466/473, 130/254/284/322/374/409/466, 130/257/284/374/409/466, 130/284/322/374/409/473, 149/257/284/322/409/466, 158/272/279/394/396/412/428/493, 158/272/388/412/428/493, 158/272/412/428, 158/279/388/396/412/428, 254/257/284/322/409/473, 254/284/409/466/495, 272/279/412/428/493, 272/412/428, 272/412/493, and 284/322/409/473, wherein the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 40 or 988. In some further embodiments, the recombinant amylase comprises a polypeptide sequence having at least 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99%, or more sequence identity to SEQ ID NO: 40 or 988, or a functional fragment thereof, and wherein the recombinant amylase comprises at least one substitution or substitution set selected from 26A/29R/158R/272G/412D, 26A/29R/272G/279R/412D/493D, 26A/29R/272G/396H/412D, 26A/29R/279R/412D/428E, 26A/158R/272G/279R/388E/412D/428E, 26A/158R/272G/412D, 26A/272G/279R/412D/428E/493D, 29R/272G/279R/396H/412D, 130D/149R/254S/284S/322A/409S/495E, 130D/149R/257G/284S/322A/409S/466E/473D, 130D/254S/284S/322A/374S/409S/466E, 130D/257G/284S/374S/409S/466E, 130D/284S/322A/374S/409S/473D, 149R/257G/284S/322A/409S/466E, 158R/272G/279R/394R/396H/412D/428E/493D, 158R/272G/388E/412D/428E/493D, 158R/272G/412D/428E, 158R/279R/388E/396H/412D/428E, 254S/257G/284S/322A/409S/473D, 254S/284S/409S/466E/495E, 272G/279R/412D/428E/493D, 272G/412D/428E, 272G/412D/493D, and 284S/322A/409S/473D, wherein the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 40 or 988. In some further embodiments, the recombinant amylase comprises a polypeptide sequence having at least 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99%, or more sequence identity to SEQ ID NO: 40 or 988, or a functional fragment thereof, and wherein the recombinant amylase comprises at least one substitution or substitution set selected from E26A/D29R/K158R/D272G/L412D, E26A/D29R/D272G/D279R/L412D/E493D, E26A/D29R/D272G/D396H/L412D, E26A/D29R/D279R/L412D/D428E, E26A/K158R/D272G/D279R/D388E/L412D/D428E, E26A/K158R/D272G/L412D, E26A/D272G/D279R/L412D/D428E/E493D, D29R/D272G/D279R/D396H/L412D, E130D/Q149R/E254S/K284S/F322A/V409S/I495E, E130D/Q149R/P257G/K284S/F322A/V409S/Q466E/E473D, E130D/E254S/K284S/F322A/H374S/V409S/Q466E, E130D/P257G/K284S/H374S/V409S/Q466E, E130D/K284S/F322A/H374S/V409S/E473D, Q149R/P257G/K284S/F322A/V409S/Q466E, K158R/D272G/D279R/Q394R/D396H/L412D/D428E/E493D, K158R/D272G/D388E/L412D/D428E/E493D, K158R/D272G/L412D/D428E, K158R/D279R/D388E/D396H/L412D/D428E, E254S/P257G/K284S/F322A/V409S/E473D, E254S/K284S/V409S/Q466E/I495E, D272G/D279R/L412D/D428E/E493D, D272G/L412D/D428E,

D272G/L412D/E493D, and K284S/F322A/V409S/E473D, wherein the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 40 or 988.

[0013] In some additional embodiments, the recombinant amylase comprises a polypeptide sequence having at least 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99%, or more sequence identity to SEQ ID NO: 156 or 1104, or a functional fragment thereof, and wherein the recombinant amylase comprises at least one substitution or substitution set at one or more positions selected from 37, 51, 91, 111, 112, 114, 122, 124, 128, 140, 167, 171, 183, 194, 276, 280, 298, 397, and 464, wherein the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 156 or 1104. In some further embodiments, the recombinant amylase comprises a polypeptide sequence having at least 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99%, or more sequence identity to SEQ ID NO: 156 or 1104, or a functional fragment thereof, and wherein the recombinant amylase comprises at least one substitution or substitution set selected from 37R, 51R, 91H, 111A, 112Q, 114H, 122P, 122R, 124R, 128W, 140K, 167W, 171I, 183E, 183N, 183V, 194E, 194R, 276A, 276K, 280L, 298K, 298M, 397T, and 464L, wherein the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 156 or 1104. In some further embodiments, the recombinant amylase comprises a polypeptide sequence having at least 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99%, or more sequence identity to SEQ ID NO: 156 or 1104, or a functional fragment thereof, and wherein the recombinant amylase comprises at least one substitution or substitution set selected from N37R, G51R, K91H, E111A, K112Q, A114H, A122P, A122R, D124R, I128W, R140K, E167W, E171I, G183E, G183N, G183V, L194E, L194R, T276A, T276K, Q280L, E298K, E298M, E397T, and N464L, wherein the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 156 or 1104.

[0014] In some additional embodiments, the recombinant amylase comprises a polypeptide sequence having at least 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99%, or more sequence identity to SEQ ID NO: 174 or 1122, or a functional fragment thereof, and wherein the recombinant amylase comprises at least one substitution or substitution set at one or more positions selected from 24, 91, 91/122, 91/122/128/130/167/171/409, 91/122/128/130/183/322, 91/122/128/130/194, 91/122/128/130/322, 91/122/128/171/183/194/322, 91/122/128/183/409, 91/122/130/167/183/194/409, 91/122/130/171/183, 91/122/130/183/194, 91/122/130/194, 91/122/130/194/322, 91/122/167/171/194, 91/122/167/171/194/322, 91/122/171/183/194/409, 91/130/171/183/322/409, 91/167/171, 91/167/183/194, 91/167/322, 91/183, 91/183/322/409, 91/194, 91/322, 91/409, 122/128, 122/128/194/409, 122/130/171/322/409, 122/409, 137/145/227/394/480/481, 137/145/295, 145/227/295/481, 145/309/481, 183, 227, 295/394, 322, 322/409, 394, and 480/481, wherein the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 174 or 1122. In some further embodiments, the

recombinant amylase comprises a polypeptide sequence having at least 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99%, or more sequence identity to SEQ ID NO: 174 or 1122, or a functional fragment thereof, and wherein the recombinant amylase comprises at least one substitution or substitution set selected from 24V, 91H, 91H/122P, 91H/122P/130D/183N/194R, 91H/122P/130D/194R/322A, 91H/122R, 91H/122R/128W/130D/167W/171I/409S, 91H/122R/128W/130D/183N/322A, 91H/122R/128W/130D/194R, 91H/122R/128W/130D/322A, 91H/122R/128W/171I/183N/194R/322A, 91H/122R/128W/183N/409S, 91H/122R/130D/167W/183N/194R/409S, 91H/122R/130D/171I/183N, 91H/122R/130D/194R, 91H/122R/167W/171I/194R, 91H/122R/167W/171I/194R/322A, 91H/122R/171I/183N/194R/409S, 91H/130D/171I/183N/322A/409S, 91H/167W/171I, 91H/167W/183N/194R, 91H/167W/322A, 91H/183N, 91H/183N/322A/409S, 91H/194R, 91H/322A, 91H/409S, 122P/409S, 122R/128W, 122R/128W/194R/409S, 122R/130D/171I/322A/409S, 137A/145G/227L/394E/480P/481V, 137A/145G/295N, 145G/227L/295N/481V, 145G/309S/481V, 183N, 227L, 295N/394E, 322A, 322A/409S, 394E, and 480T/481V, wherein the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 174 or 1122. In some further embodiments, the recombinant amylase comprises a polypeptide sequence having at least 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99%, or more sequence identity to SEQ ID NO: 174 or 1122, or a functional fragment thereof, and wherein the recombinant amylase comprises at least one substitution or substitution set selected from L24V, K91H, K91H/A122P, K91H/A122P/E130D/G183N/L194R, K91H/A122P/E130D/L194R/F322A, K91H/A122R, K91H/A122R/I128W/E130D/E167W/E171I/V409S, K91H/A122R/I128W/E130D/G183N/F322A, K91H/A122R/I128W/E130D/L194R, K91H/A122R/I128W/E130D/F322A, K91H/A122R/I128W/E171I/G183N/L194R/F322A, K91H/A122R/I128W/G183N/V409S, K91H/A122R/E130D/E167W/G183N/L194R/V409S, K91H/A122R/E130D/E171I/G183N, K91H/A122R/E130D/L194R, K91H/A122R/E167W/E171I/L194R, K91H/A122R/E167W/E171I/L194R/F322A, K91H/A122R/E171I/G183N/L194R/V409S, K91H/E130D/E171I/G183N/F322A/V409S, K91H/E167W/E171I, K91H/E167W/G183N/L194R, K91H/E167W/F322A, K91H/G183N, K91H/G183N/F322A/V409S, K91H/L194R, K91H/F322A, K91H/V409S, A122P/V409S, A122R/I128W, A122R/I128W/L194R/V409S, A122R/E130D/E171I/F322A/V409S, G137A/A145G/T227L/Q394E/F480P/C481V, G137A/A145G/K295N, A145G/T227L/K295N/C481V, A145G/T309S/C481V, G183N, T227L, K295N/Q394E, F322A, F322A/V409S, Q394E, and F480T/C481V, wherein the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 174 or 1122.

[0015] In some additional embodiments, the recombinant amylase comprises a polypeptide sequence having at least 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%,

99%, or more sequence identity to SEQ ID NO: 276 or 1224, or a functional fragment thereof, and wherein the recombinant amylase comprises at least one substitution or substitution set at one or more positions selected from 16/26/29/128/145/256/309/383, 16/26/33/114/145/309/383/394, 16/26/33/128/130/145/302/309/322/371, 16/26/33/145/158/383/394, 16/26/145/302, 16/29/33/145/256/302, 18, 26/29/33/130/145/157/158/183/394, 26/29/33/145/157/183/256/309/383, 26/29/122/130/145/183/256/272/309/394, 26/29/145/157/256/302/322/481, 26/29/145/256/272/302/309/322/481, 26/33/91/145/272/302/481, 26/33/145/309/322/383, 26/114/145/322, 26/145/183/256/309/383, 29/122/145/158/383, 29/130/145/256/272/371/394, 29/145/183/302/309/412, 29/309/394, 33/122/145/272/309/412, 91/130/145/158/183/383, 91/309/383, 130/145/256/272/371, 130/145/302/309, 130/272/481, 145/302/309, 268, 309, 349, 360, 380, 394, 463, and 483, wherein the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 276 or 1224. In some further embodiments, the recombinant amylase comprises a polypeptide sequence having at least 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99%, or more sequence identity to SEQ ID NO: 276 or 1224, or a functional fragment thereof, and wherein the recombinant amylase comprises at least one substitution or substitution set selected from 16E/26E/29D/128I/145G/256A/309S/383Q, 16E/26E/33D/114A/145G/309S/383Q/394E, 16E/26E/33D/128I/130E/145G/302M/309S/322F/371Y, 16E/26E/33D/145G/158K/383Q/394E, 16E/26E/145G/302M, 16E/29D/33D/145G/256A/302M, 18S, 26E/29D/33D/130E/145G/157F/158K/183G/394E, 26E/29D/33D/145G/157F/183G/256A/309S/383Q, 26E/29D/122A/130E/145G/183G/256A/272D/309S/394E, 26E/29D/145G/157F/256A/302M/322F/481V, 26E/29D/145G/256A/272D/302M/309S/322F/481V, 26E/33D/91K/145G/272D/302M/481V, 26E/33D/145G/309S/322F/383Q, 26E/114A/145G/322F, 26E/145G/183G/256A/309S/383Q, 29D/122A/145G/158K/383Q, 29D/130E/145G/256A/272D/371Y/394E, 29D/145G/183G/302M/309S/412L, 29D/309S/394E, 33D/122A/145G/272D/309S/412L, 91K/130E/145G/158K/183G/383Q, 91K/309S/383Q, 130E/145G/256A/272D/371Y, 130E/145G/302M/309S, 130E/272D/481V, 145G/302M/309S, 268T, 309A, 349R, 360G, 380R, 394G, 394N, 394S, 463M, and 483T, wherein the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 276 or 1224. In some further embodiments, the recombinant amylase comprises a polypeptide sequence having at least 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99%, or more sequence identity to SEQ ID NO: 276 or 1224, or a functional fragment thereof, and wherein the recombinant amylase comprises at least one substitution or substitution set selected from D16E/A26E/R29D/W128I/A145G/S256A/T309S/E383Q, D16E/A26E/E33D/H114A/A145G/T309S/E383Q/Q394E, D16E/A26E/E33D/W128I/D130E/A145G/Q302M/T309S/A322F/F371Y, D16E/A26E/E33D/A145G/R158K/E383Q/Q394E, D16E/A26E/A145G/Q302M,

D16E/R29D/E33D/A145G/S256A/Q302M, G18S,
A26E/R29D/E33D/D130E/A145G/Y157F/R158K/N183G/Q394E,
A26E/R29D/E33D/A145G/Y157F/N183G/S256A/T309S/E383Q,
A26E/R29D/R122A/D130E/A145G/N183G/S256A/G272D/T309S/Q394E,
A26E/R29D/A145G/Y157F/S256A/Q302M/A322F/C481V,
A26E/R29D/A145G/S256A/G272D/Q302M/T309S/A322F/C481V,
A26E/E33D/H91K/A145G/G272D/Q302M/C481V, A26E/E33D/A145G/T309S/A322F/E383Q,
A26E/H114A/A145G/A322F, A26E/A145G/N183G/S256A/T309S/E383Q,
R29D/R122A/A145G/R158K/E383Q, R29D/D130E/A145G/S256A/G272D/F371Y/Q394E,
R29D/A145G/N183G/Q302M/T309S/D412L, R29D/T309S/Q394E,
E33D/R122A/A145G/G272D/T309S/D412L, H91K/D130E/A145G/R158K/N183G/E383Q,
H91K/T309S/E383Q, D130E/A145G/S256A/G272D/F371Y, D130E/A145G/Q302M/T309S,
D130E/G272D/C481V, A145G/Q302M/T309S, S268T, T309A, P349R, N360G, G380R, Q394G,
Q394N, Q394S, G463M, and G483T, wherein the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 276 or 1224.

[0016] In some additional embodiments, the recombinant amylase comprises a polypeptide sequence having at least 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99%, or more sequence identity to SEQ ID NO: 308 or 1256, or a functional fragment thereof, and wherein the recombinant amylase comprises at least one substitution or substitution set at one or more positions selected from 29, 37/124/250/270/349/380/394/442/491, 37/145, 37/145/250/301/349/394, 37/145/258/442/491, 38/349/491, 81/259, 81/313/495, 92/257/258/338/468, 92/258, 94/127/132/145/250/349, 94/270/301/349/394/442, 94/349/491, 145/270, 178, 225, 226, 246, 250/349/442, 259/313/338, 270/349, 286/338, 294, 313, 349, 349/380/442, 413, 413/468, 448, and 473, wherein the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 308 or 1256. In some further embodiments, the recombinant amylase comprises a polypeptide sequence having at least 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99%, or more sequence identity to SEQ ID NO: 308 or 1256, or a functional fragment thereof, and wherein the recombinant amylase comprises at least one substitution or substitution set selected from 29A, 37T/124N/250D/270D/349R/380R/394E/442E/491L, 37T/145G, 37T/145G/250D/301K/349R/394E, 37T/145G/258S/442E/491L, 38I/349R/491L, 81E/259D, 81E/313D/495L, 92E/257E/258Q/338S/468T, 92E/258Q, 94G/127E/132V/145G/250D/349R, 94G/270D/301K/349R/394E/442E, 94G/349R/491L, 145G/270D, 178I, 225D, 226T, 246R, 250D/349R/442E, 259D/313D/338S, 270D/349R, 286T/338S, 294L, 313D, 349R, 349R/380R/442E, 413Y, 413Y/468I, 448T, and 473D, wherein the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 308 or 1256. In some further embodiments, the recombinant amylase comprises a polypeptide sequence having at least 80%, 85%, 86%, 87%, 88%,

89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99%, or more sequence identity to SEQ ID NO: 308 or 1256, or a functional fragment thereof, and wherein the recombinant amylase comprises at least one substitution or substitution set selected from R29A, N37T/D124N/E250D/E270D/P349R/G380R/G394E/D442E/I491L, N37T/A145G, N37T/A145G/E250D/R301K/P349R/G394E, N37T/A145G/K258S/D442E/I491L, M38I/P349R/I491L, A81E/P259D, A81E/T313D/I495L, R92E/P257E/K258Q/A338S/R468T, R92E/K258Q, D94G/Q127E/I132V/A145G/E250D/P349R, D94G/E270D/R301K/P349R/G394E/D442E, D94G/P349R/I491L, A145G/E270D, V178I, E225D, Q226T, K246R, E250D/P349R/D442E, P259D/T313D/A338S, E270D/P349R, M286T/A338S, M294L, T313D, P349R, P349R/G380R/D442E, F413Y, F413Y/R468I, H448T, and E473D, wherein the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 308 or 1256.

[0017] In some additional embodiments, the recombinant amylase comprises a polypeptide sequence having at least 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99%, or more sequence identity to SEQ ID NO: 422 or 1370, or a functional fragment thereof, and wherein the recombinant amylase comprises at least one substitution or substitution set at one or more positions selected from 38, 38/178/226/286/338, 38/178/286/448, 38/178/349/448, 38/226/246/258/286, 38/226/258/286/338/380/448, 38/226/258/349/413, 38/226/286, 38/226/286/338/380, 38/226/338/349/380, 38/226/413/448, 38/246/286, 38/246/286/380, 38/258, 38/286, 38/286/413/448, 38/286/448, 38/448, 178, 178/226/258/286/310/338, 178/226/286/338, 178/246/338, 178/258/286/413, 178/286, 178/286/338/349, 178/286/338/448, 178/380, 178/413, 178/448, 184/246/258/380, 226, 226/246/286/349/448, 226/246/413, 226/258/286/349/380, 226/258/286/413/448, 226/286, 226/286/380/448, 226/349/380, 246, 246/286, 246/286/380/413, 246/338, 246/413, 258/286/413, 286, 286/413/448, 338/448, 349, and 413, wherein the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 422 or 1370. In some further embodiments, the recombinant amylase comprises a polypeptide sequence having at least 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99%, or more sequence identity to SEQ ID NO: 422 or 1370, or a functional fragment thereof, and wherein the recombinant amylase comprises at least one substitution or substitution set selected from 38I, 38I/178I/226T/286T/338S, 38I/178I/286T/448T, 38I/178I/349R/448T, 38I/226T/246R/258S/286T, 38I/226T/258S/286T/338S/380R/448T, 38I/226T/258S/349R/413Y, 38I/226T/286T, 38I/226T/286T/338S/380R, 38I/226T/338S/349R/380R, 38I/226T/413Y/448T, 38I/246R/286T, 38I/246R/286T/380R, 38I/258S, 38I/286T, 38I/286T/413Y/448T, 38I/286T/448T, 38I/448T, 178I, 178I/226T/258S/286T/310R/338S, 178I/226T/286T/338S, 178I/246R/338S, 178I/258S/286T/413Y, 178I/286T, 178I/286T/338S/349R, 178I/286T/338S/448T, 178I/380R, 178I/413Y, 178I/448T, 184K/246R/258S/380R, 226T, 226T/246R/286T/349R/448T, 226T/246R/413Y,

226T/258S/286T/349R/380R, 226T/258S/286T/413Y/448T, 226T/286T, 226T/286T/380R/448T, 226T/349R/380R, 246R, 246R/286T, 246R/286T/380R/413Y, 246R/338S, 246R/413Y, 246T, 258S/286T/413Y, 286T, 286T/413Y/448T, 338S/448T, 349R, and 413Y, wherein the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 422 or 1370. In some further embodiments, the recombinant amylase comprises a polypeptide sequence having at least 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99%, or more sequence identity to SEQ ID NO: 422 or 1370, or a functional fragment thereof, and wherein the recombinant amylase comprises at least one substitution or substitution set selected from M38I, M38I/V178I/Q226T/M286T/A338S, M38I/V178I/M286T/H448T, M38I/V178I/P349R/H448T, M38I/Q226T/K246R/K258S/M286T, M38I/Q226T/K258S/M286T/A338S/G380R/H448T, M38I/Q226T/K258S/P349R/F413Y, M38I/Q226T/M286T, M38I/Q226T/M286T/A338S/G380R, M38I/Q226T/A338S/P349R/G380R, M38I/Q226T/F413Y/H448T, M38I/K246R/M286T, M38I/K246R/M286T/G380R, M38I/K258S, M38I/M286T, M38I/M286T/F413Y/H448T, M38I/M286T/H448T, M38I/H448T, V178I, V178I/Q226T/K258S/M286T/Q310R/A338S, V178I/Q226T/M286T/A338S, V178I/K246R/A338S, V178I/K258S/M286T/F413Y, V178I/M286T, V178I/M286T/A338S/P349R, V178I/M286T/A338S/H448T, V178I/G380R, V178I/F413Y, V178I/H448T, E184K/K246R/K258S/G380R, Q226T, Q226T/K246R/M286T/P349R/H448T, Q226T/K246R/F413Y, Q226T/K258S/M286T/P349R/G380R, Q226T/K258S/M286T/F413Y/H448T, Q226T/M286T, Q226T/M286T/G380R/H448T, Q226T/P349R/G380R, K246R, K246R/M286T, K246R/M286T/G380R/F413Y, K246R/A338S, K246R/F413Y, K246T, K258S/M286T/F413Y, M286T, M286T/F413Y/H448T, A338S/H448T, P349R, and F413Y, wherein the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 422 or 1370.

[0018] In some additional embodiments, the recombinant amylase comprises a polypeptide sequence having at least 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99%, or more sequence identity to SEQ ID NO: 456 or 1404, or a functional fragment thereof, and wherein the recombinant amylase comprises at least one substitution or substitution set at one or more positions selected from 29/31/92/220, 29/469, 49/58/103/141/197/269/294/298, 49/58/103/194/204/298, 49/58/141/298, 49/103, 103, 123, 126, 127, 131, 134, 180, 210, 214, 220/469, 228, 259, 279, 282, 302, 319, 393, 415, 417, 428, 429, 466, and 469, wherein the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 456 or 1404. In some further embodiments, the recombinant amylase comprises a polypeptide sequence having at least 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99%, or more sequence identity to SEQ ID NO: 456 or 1404, or a functional fragment thereof, and wherein the recombinant amylase comprises at least one substitution or substitution set selected from 29E/31L/92A/220G, 29E/469I, 49A/58T/103L/141F/197Y/269F/294H/298Q, 49A/58T/103L/194F/204D/298H, 49A/58T/141F/298H, 49A/103L, 103L, 123R, 126R, 127W, 131H,

131R, 131Y, 134R, 180E, 210P, 214G, 220G/469I, 228V, 259C, 279L, 282T, 302H, 302R, 302W, 319S, 393R, 393S, 415C, 417W, 428T, 429S, 466C, and 469I, wherein the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 456 or 1404. In some further embodiments, the recombinant amylase comprises a polypeptide sequence having at least 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99%, or more sequence identity to SEQ ID NO: 456 or 1404, or a functional fragment thereof, and wherein the recombinant amylase comprises at least one substitution or substitution set selected from R29E/F31L/R92A/A220G, R29E/V469I, S49A/S58T/V103L/Y141F/F197Y/H269F/M294H/E298Q, S49A/S58T/V103L/L194F/N204D/E298H, S49A/S58T/Y141F/E298H, S49A/V103L, V103L, D123R, T126R, Q127W, E131H, E131R, E131Y, E134R, D180E, H210P, E214G, A220G/V469I, Q228V, P259C, D279L, E282T, Q302H, Q302R, Q302W, A319S, E393R, E393S, D415C, P417W, D428T, E429S, Q466C, and V469I, wherein the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 456 or 1404.

[0019] In some additional embodiments, the recombinant amylase comprises a polypeptide sequence having at least 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99%, or more sequence identity to SEQ ID NO: 456 or 1404, or a functional fragment thereof, and wherein the recombinant amylase comprises at least one substitution or substitution set at one or more positions selected from 92, 123, 126, 127, 129, 131, 134, 140, 172, 180, 210, 214, 221, 228, 253, 254, 259, 279, 282, 302, 304, 305, 319, 322, 346, 359, 384, 385, 387, 393, 409, 412, 415, 417, 428, 429, 441, 442, 444, 446, 451, 455, 459, 466, 467, 470, 473, 474, 492, and 494, wherein the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 456 or 1404. In some further embodiments, the recombinant amylase comprises a polypeptide sequence having at least 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99%, or more sequence identity to SEQ ID NO: 456 or 1404, or a functional fragment thereof, and wherein the recombinant amylase comprises at least one substitution or substitution set selected from 92G, 92Q, 123C, 123G, 123R, 126Q, 126R, 127I, 127R, 127S, 127V, 127W, 129C, 129W, 131H, 131R, 131Y, 134A, 134F, 134R, 140V, 172K, 172R, 180E, 180P, 180Q, 210G, 210P, 214G, 214L, 214R, 221T, 221V, 228V, 253R, 254G, 259C, 259R, 259W, 279L, 279V, 282R, 282T, 302G, 302H, 302R, 302V, 302W, 304T, 305Q, 305R, 305W, 319L, 319S, 322R, 346G, 359G, 384M, 385L, 387G, 387V, 393R, 393S, 393W, 409A, 409R, 409W, 412A, 415C, 415G, 417W, 428T, 429S, 441R, 441W, 442R, 442W, 444G, 444R, 444V, 446G, 451F, 455L, 455R, 455T, 455W, 459W, 466C, 467P, 467W, 470G, 470L, 470S, 473M, 474G, 492G, 492R, and 494C, wherein the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 456 or 1404. In some further embodiments, the recombinant amylase comprises a polypeptide sequence having at least 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99%, or more sequence identity to SEQ ID NO: 456 or 1404, or a functional fragment thereof, and wherein the recombinant amylase

comprises at least one substitution or substitution set selected from R92G, R92Q, D123C, D123G, D123R, T126Q, T126R, Q127I, Q127R, Q127S, Q127V, Q127W, D129C, D129W, E131H, E131R, E131Y, E134A, E134F, E134R, R140V, D172K, D172R, D180E, D180P, D180Q, H210G, H210P, E214G, E214L, E214R, R221T, R221V, Q228V, Q253R, E254G, P259C, P259R, P259W, D279L, D279V, E282R, E282T, Q302G, Q302H, Q302R, Q302V, Q302W, R304T, D305Q, D305R, D305W, A319L, A319S, A322R, W346G, E359G, T384M, Y385L, I387G, I387V, E393R, E393S, E393W, V409A, V409R, V409W, D412A, D415C, D415G, P417W, D428T, E429S, D441R, D441W, D442R, D442W, E444G, E444R, E444V, T446G, E451F, N455L, N455R, N455T, N455W, R459W, Q466C, E467P, E467W, V470G, V470L, V470S, E473M, N474G, E492G, E492R, and V494C, wherein the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 456 or 1404.

[0020] In some additional embodiments, the recombinant amylase comprises a polypeptide sequence having at least 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99%, or more sequence identity to SEQ ID NO: 546 or 1494, or a functional fragment thereof, and wherein the recombinant amylase comprises at least one substitution or substitution set at one or more positions selected from 123, 123/126/180/214/298/302/393, 123/126/180/214/393/428, 123/126/210/298/302/393, 123/126/210/428, 123/126/428, 123/210/302, 126/180/210/214/298/302, 126/180/210/214/428, 126/180/298/302/393, 126/210/302/428, 126/214/393, 126/298/302/393, 126/298/302/393/428, 129, 129/228/253, 131/228/279, 131/282, 180/214, 210/214/302/393/428, 228/282/444, 253/279/470, 253/279/492, 279, 279/470, and 441, wherein the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 546 or 1494. In some further embodiments, the recombinant amylase comprises a polypeptide sequence having at least 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99%, or more sequence identity to SEQ ID NO: 546 or 1494, or a functional fragment thereof, and wherein the recombinant amylase comprises at least one substitution or substitution set selected from 123R, 123R/126R/180E/214L/298Q/302W/393R, 123R/126R/180Q/214G/393R/428T, 123R/126R/210P/298Q/302W/393R, 123R/126R/210P/428T, 123R/126R/428T, 123R/210P/302R, 126R/180E/210P/214G/428T, 126R/180E/298Q/302R/393R, 126R/180Q/210P/214L/298Q/302R, 126R/210P/302R/428T, 126R/214G/393R, 126R/298Q/302H/393R, 126R/298Q/302R/393R/428T, 129W, 129W/228V/253R, 131H/228V/279V, 131Y/282T, 180Q/214L, 210P/214L/302R/393R/428T, 228V/282T/444R, 253R/279L/492G, 253R/279V/470S, 279L, 279L/470S, and 441R, wherein the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 546 or 1494. In some further embodiments, the recombinant amylase comprises a polypeptide sequence having at least 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99%, or more sequence identity to SEQ ID NO: 546 or 1494, or a functional fragment thereof, and wherein the recombinant amylase comprises at least one substitution or substitution set selected from

D123R, D123R/T126R/D180E/E214L/H298Q/Q302W/E393R, D123R/T126R/D180Q/E214G/E393R/D428T, D123R/T126R/H210P/H298Q/Q302W/E393R, D123R/T126R/H210P/D428T, D123R/T126R/D428T, D123R/H210P/Q302R, T126R/D180E/H210P/E214G/D428T, T126R/D180E/H298Q/Q302R/E393R, T126R/D180Q/H210P/E214L/H298Q/Q302R, T126R/H210P/Q302R/D428T, T126R/E214G/E393R, T126R/H298Q/Q302H/E393R, T126R/H298Q/Q302R/E393R/D428T, D129W, D129W/Q228V/Q253R, E131H/Q228V/D279V, E131Y/E282T, D180Q/E214L, H210P/E214L/Q302R/E393R/D428T, Q228V/E282T/E444R, Q253R/D279L/E492G, Q253R/D279V/V470S, D279L, D279L/V470S, and D441R, wherein the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 546 or 1494.

[0021] In some additional embodiments, the recombinant amylase comprises a polypeptide sequence having at least 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99%, or more sequence identity to SEQ ID NO: 632 or 1580, or a functional fragment thereof, and wherein the recombinant amylase comprises at least one substitution or substitution set at one or more positions selected from 2, 45/166/298, 48, 48/166/170/203, 52, 58/166, 58/203, 72, 82, 114, 114/223/306/308, 149, 165, 166/203, 167, 170, 184/216/306/308, 184/223/306/437, 189, 203, 225, 255, 258, 275, 280, 284, 294, 298, 396, 397, 411, 431, 448, 468, 482, 483, and 495, wherein the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 632 or 1580. In some further embodiments, the recombinant amylase comprises a polypeptide sequence having at least 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99%, or more sequence identity to SEQ ID NO: 632 or 1580, or a functional fragment thereof, and wherein the recombinant amylase comprises at least one substitution or substitution set selected from 2L, 45S/166L/298D, 48D, 48D/166L/170S/203S, 52R, 58A/166L, 58A/203S, 72T, 82A, 114R, 114R/223L/306F/308L, 149K, 165V, 166L/203S, 167Y, 170S, 184D/216L/306F/308L, 184D/223L/306F/437L, 189D, 203S, 225T, 255M, 255R, 258S, 275I, 275R, 280C, 284L, 284M, 294A, 298D, 298N, 396E, 396Q, 397M, 411E, 431T, 448P, 468V, 482L, 483A, 495G, and 495L, wherein the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 632 or 1580. In some further embodiments, the recombinant amylase comprises a polypeptide sequence having at least 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99%, or more sequence identity to SEQ ID NO: 632 or 1580, or a functional fragment thereof, and wherein the recombinant amylase comprises at least one substitution or substitution set selected from R2L, Y45S/I166L/H298D, A48D, A48D/I166L/D170S/E203S, Y52R, T58A/I166L, T58A/E203S, S72T, Q82A, H114R, H114R/V223L/Y306F/M308L, Q149K, H165V, I166L/E203S, E167Y, D170S, E184D/I216L/Y306F/M308L, E184D/V223L/Y306F/M437L, Q189D, E203S, E225T, V255M, V255R, K258S, Q275I, Q275R, Q280C, K284L, K284M, M294A, H298D, H298N, D396E, D396Q, E397M, T411E, P431T, H448P, R468V, N482L, G483A, I495G, and I495L, wherein

the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 632 or 1580.

[0022] In some additional embodiments, the recombinant amylase comprises a polypeptide sequence having at least 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99%, or more sequence identity to SEQ ID NO: 664 or 1612, or a functional fragment thereof, and wherein the recombinant amylase comprises at least one substitution or substitution set at one or more positions selected from 6/39/103/324/420, 41, 58/500/501, 61, 95/98/205/227/423/458, 95/98/227/423, 95/205, 95/252/285/324, 123/170/197/275/298/396/448/483, 123/197, 123/197/225/294/396/448/469, 123/284/294/324/396/448, 134/225/275/302, 165/225/284/298/469/483, 170/275/294/298/448, 205/206, 205/206/224/315/458/480, 206/227, 206/227/315/423, 225/294/298/396, 227, 392/503, 458, 499, and 500, wherein the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 664 or 1612. In some further embodiments, the recombinant amylase comprises a polypeptide sequence having at least 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99%, or more sequence identity to SEQ ID NO: 664 or 1612, or a functional fragment thereof, and wherein the recombinant amylase comprises at least one substitution or substitution set selected from 6I/39I/103D/324T/420V, 41F, 58S/500P/501P, 61Y, 95L/252I/285V/324T, 95V/98I/205V/227V/423V/458F, 95V/98I/227V/423V, 95V/205V, 123E/170S/197Y/275I/298N/396Q/448Q/483Q, 123E/197Y, 123E/197Y/225G/294A/396Q/448Q/469I, 123E/284L/294A/324T/396Q/448Q, 134R/225G/275I/302W, 165V/225G/284L/298N/469I/483Q, 170S/275I/294A/298N/448Q, 205V/206E, 205V/206E/224L/315S/458F/480L, 206E/227V, 206E/227V/315S/423V, 225G/294A/298N/396Q, 227C, 392C/503L, 458F, 458Y, 499R, and 500P, wherein the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 664 or 1612. In some further embodiments, the recombinant amylase comprises a polypeptide sequence having at least 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99%, or more sequence identity to SEQ ID NO: 664 or 1612, or a functional fragment thereof, and wherein the recombinant amylase comprises at least one substitution or substitution set selected from L6I/V39I/V103D/A324T/I420V, L41F, T58S/H500P/H501P, L61Y, I95L/V252I/T285V/A324T, I95V/L98I/I205V/T227V/S423V/W458F, I95V/L98I/T227V/S423V, I95V/I205V, D123E/D170S/F197Y/Q275I/H298N/D396Q/H448Q/G483Q, D123E/F197Y, D123E/F197Y/E225G/M294A/D396Q/H448Q/V469I, D123E/K284L/M294A/A324T/D396Q/H448Q, E134R/E225G/Q275I/Q302W, H165V/E225G/K284L/H298N/V469I/G483Q, D170S/Q275I/M294A/H298N/H448Q, I205V/D206E, I205V/D206E/M224L/T315S/W458F/F480L, D206E/T227V, D206E/T227V/T315S/S423V, E225G/M294A/H298N/D396Q, T227C, I392C/H503L, W458F, W458Y, G499R, and H500P,

wherein the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 664 or 1612.

[0023] In some additional embodiments, the recombinant amylase comprises a polypeptide sequence having at least 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99%, or more sequence identity to SEQ ID NO: 664 or 1612, or a functional fragment thereof, and wherein the recombinant amylase comprises at least one substitution or substitution set at one or more positions selected from 95/252/285/324, 123/197, 123/197/225/294/396/448/469, 134/225/275/302, 205/206, and 205/206/224/315/458/480, wherein the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 664 or 1612. In some further embodiments, the recombinant amylase comprises a polypeptide sequence having at least 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99%, or more sequence identity to SEQ ID NO: 664 or 1612, or a functional fragment thereof, and wherein the recombinant amylase comprises at least one substitution or substitution set selected from 95L/252I/285V/324T, 123E/197Y, 123E/197Y/225G/294A/396Q/448Q/469I, 134R/225G/275I/302W, 205V/206E, and 205V/206E/224L/315S/458F/480L, wherein the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 664 or 1612. In some further embodiments, the recombinant amylase comprises a polypeptide sequence having at least 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99%, or more sequence identity to SEQ ID NO: 664 or 1612, or a functional fragment thereof, and wherein the recombinant amylase comprises at least one substitution or substitution set selected from I95L/V252I/T285V/A324T, D123E/F197Y, D123E/F197Y/E225G/M294A/D396Q/H448Q/V469I, E134R/E225G/Q275I/Q302W, I205V/D206E, and I205V/D206E/M224L/T315S/W458F/F480L, wherein the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 664 or 1612.

[0024] In some additional embodiments, the recombinant amylase comprises a polypeptide sequence having at least 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99%, or more sequence identity to SEQ ID NO: 780 or 1728, or a functional fragment thereof, and wherein the recombinant amylase comprises a substitution at position 126, wherein the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 780 or 1728. In some further embodiments, the recombinant amylase comprises a polypeptide sequence having at least 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99%, or more sequence identity to SEQ ID NO: 780 or 1728, or a functional fragment thereof, and wherein the recombinant amylase comprises at least one substitution or substitution set selected from 126C, 126D, 126E, 126K, 126L, 126M, 126N, 126Q, 126S, 126T, and 126W, wherein the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 780 or 1728. In some further embodiments, the recombinant amylase comprises a polypeptide sequence having at least 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99%, or more sequence

identity to SEQ ID NO: 780 or 1728, or a functional fragment thereof, and wherein the recombinant amylase comprises at least one substitution or substitution set selected from R126C, R126D, R126E, R126K, R126L, R126M, R126N, R126Q, R126S, R126T, and R126W, wherein the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 780 or 1728.

[0025] In some additional embodiments, the recombinant amylase comprises at least one mutation in at least one position as provided in Table 4-1, 4-2, 4-3, 4-4, 4-5, 4-6, 4-7, 4-8, 4-9, 4-10, 4-11, 4-12, 4-13, and/or 4-14, wherein the positions are numbered with reference to SEQ ID NO: 2, 18, 40, 156, 174, 276, 308, 422, 456, 546, 632, 780, 988, 1104, 1122, 1224, 1256, 1370, 1404, 1494, 1580, 1612, and/or 1728. In some further embodiments, the recombinant amylase comprises a polypeptide sequence having at least about 80%, 85%, about 86%, about 87%, about 88%, about 89%, about 90%, about 91%, about 92%, about 93%, about 94%, about 95%, about 96%, about 97%, about 98%, about 99%, or more sequence identity to at least one sequence set forth in the even-numbered sequences of SEQ ID NOS: 4-18, 22-966, and 970-1914. In some further embodiments, the recombinant amylase comprises a polypeptide sequence having at least 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99%, or more sequence identity to at least one sequence set forth in the even-numbered sequences of SEQ ID NOS: 4-18, 22-966, and 970-1914. In some embodiments, the recombinant amylase comprises a polypeptide sequence having at least 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99%, or more sequence identity to a polypeptide sequence of SEQ ID NO: 40, 156, 174, 276, 308, 422, 456, 546, 632, 664, 780, 810, 988, 1104, 1122, 1224, 1256, 1370, 1404, 1494, 1580, 1612, 1728, or 1758.

[0026] In some additional embodiments, the recombinant amylase comprises at least one sequence set forth in the even-numbered sequences of SEQ ID NOS: 4-18, 22-966, and 970-1914. In some embodiments, the recombinant amylase comprises a polypeptide sequence of SEQ ID NO: 40, 156, 174, 276, 308, 422, 456, 546, 632, 664, 780, 810, 988, 1104, 1122, 1224, 1256, 1370, 1404, 1494, 1580, 1612, 1728, or 1758.

[0027] In some additional embodiments, the recombinant amylase retains more enzymatic activity after exposure to high and/or low temperatures, as compared to a reference sequence. In some embodiments, the reference sequence is wild-type amylase, while in some other embodiments, the reference sequence is another recombinant amylase. In some additional embodiments, the recombinant amylase is more thermostable than the amylase of SEQ ID NO: 2. In some further embodiments, the recombinant amylase is more thermostable than the amylase of SEQ ID NO: 18, 40, 156, 174, 276, 308, 422, 456, 546, 632, 664, 780, 988, 1104, 1122, 1224, 1256, 1370, 1404, 1494, 1580, 1612, and/or 1728. In some embodiments, the recombinant amylase is stable at 30°C, 37°C, 40°C, 50°C, 60°C, and/or 95°C, and/or 40°C to 60°C. In some embodiments, the recombinant amylase is stable at 25°C, 37°C, 42°C, and/or 48°C. In some additional embodiments, the recombinant amylase is more stable than a reference sequence at 30°C, 37°C, 40°C, 50°C, 60°C,

and/or 95°C, and/or 40°C to 60°C. In some embodiments, the recombinant amylase is more stable than a reference sequence at 30°C, 37°C, 40°C, 50°C, 60°C, and/or 95°C, and/or 40°C to 60°C. In some additional embodiments, the recombinant amylase is more thermostable than the amylase of SEQ ID NO: 2. In some further embodiments, the recombinant amylase is more thermostable than the amylase of SEQ ID NO: 18, 40, 156, 174, 276, 308, 422, 456, 546, 632, 664, 780, 988, 1104, 1122, 1224, 1256, 1370, 1404, 1494, 1580, 1612, and/or 1728.

[0028] In some embodiments, the recombinant amylase is stable in low pH environments, while in other embodiments, the recombinant amylase is stable in high pH environments, and in still further embodiments, the recombinant is stable in neutral pH environments. In some embodiments, the recombinant amylase is stable in low, high, and/or neutral pH environments. In some embodiments, the recombinant amylase retains enzymatic activity after exposure to a low, high, and/or neutral pH environment. In some additional embodiments, the recombinant amylase is more stable in high, low, and/or neutral pH environment(s), as compared to a reference sequence. In some embodiments, the reference sequence is wild-type amylase, while in other embodiments, the reference sequence is another engineered amylase. In some additional embodiments, the recombinant amylase is more stable than the amylase of SEQ ID NO: 2. In some further embodiments, the recombinant amylase is more stable than the amylase of SEQ ID NO: 18, 40, 156, 174, 276, 308, 422, 456, 546, 632, 664, 780, 988, 1104, 1122, 1224, 1256, 1370, 1404, 1494, 1580, 1612, and/or 1728. In some additional embodiments, the recombinant amylase is more stable at pHs greater than 7, than the amylase of SEQ ID NO: 2. In some additional embodiments, the recombinant amylase is more stable at pHs greater than 7, than the amylase of SEQ ID NO: 18, 40, 156, 174, 276, 308, 422, 456, 546, 632, 664, 780, 988, 1104, 1122, 1224, 1256, 1370, 1404, 1494, 1580, 1612, and/or 1728. In some additional embodiments, the recombinant amylase is more stable at pH 7.8, than the amylase of SEQ ID NO: 2. In some additional embodiments, the recombinant amylase is more stable at pH 7.8, than the amylase of SEQ ID NO: 18, 40, 156, 174, 276, 308, 422, 456, 546, 632, 664, 780, 988, 1104, 1122, 1224, 1256, 1370, 1404, 1494, 1580, 1612, and/or 1728. In some additional embodiments, the recombinant amylase is more stable at pH 7.5, than the amylase of SEQ ID NO: 2. In some additional embodiments, the recombinant amylase is more stable at pH 7.5, than the amylase of SEQ ID NO: 18, 40, 156, 174, 276, 308, 422, 456, 546, 632, 664, 780, 988, 1104, 1122, 1224, 1256, 1370, 1404, 1494, 1580, 1612, and/or 1728. In some additional embodiments, the recombinant amylase is more stable at pH 7, than the amylase of SEQ ID NO: 2. In some additional embodiments, the recombinant amylase is more stable at pH 7, than the amylase of SEQ ID NO: 18, 40, 156, 174, 276, 308, 422, 456, 546, 632, 664, 780, 988, 1104, 1122, 1224, 1256, 1370, 1404, 1494, 1580, 1612, and/or 1728. In some further embodiments, the recombinant amylase is more stable at pHs less than 7 (i.e., under acidic pH conditions or levels), than the amylase of SEQ ID NO: 2. In some additional embodiments, the recombinant amylase is more stable at pHs less than pH 7 (i.e., under acidic pH conditions or levels),

than the amylase of SEQ ID NO: 18, 40, 156, 174, 276, 308, 422, 456, 546, 632, 664, 780, 988, 1104, 1122, 1224, 1256, 1370, 1404, 1494, 1580, 1612, and/or 1728. In some additional embodiments, the recombinant amylase is more stable at pH 6.8, than the amylase of SEQ ID NO: 2. In some additional embodiments, the recombinant amylase is more stable at pH 6.8, than the amylase of SEQ ID NO: 18, 40, 156, 174, 276, 308, 422, 456, 546, 632, 664, 780, 988, 1104, 1122, 1224, 1256, 1370, 1404, 1494, 1580, 1612, and/or 1728. In some additional embodiments, the recombinant amylase is more stable at pH 6.7, than the amylase of SEQ ID NO: 2. In some additional embodiments, the recombinant amylase is more stable at pH 6.7, than the amylase of SEQ ID NO: 18, 40, 156, 174, 276, 308, 422, 456, 546, 632, 664, 780, 988, 1104, 1122, 1224, 1256, 1370, 1404, 1494, 1580, 1612, and/or 1728. In some additional embodiments, the recombinant amylase is more stable at pH 6.5, than the amylase of SEQ ID NO: 2. In some additional embodiments, the recombinant amylase is more stable at pH 6.5, than the amylase of SEQ ID NO: 18, 40, 156, 174, 276, 308, 422, 456, 546, 632, 664, 780, 988, 1104, 1122, 1224, 1256, 1370, 1404, 1494, 1580, 1612, and/or 1728. In some additional embodiments, the recombinant amylase is more stable at pH 6, than the amylase of SEQ ID NO: 2. In some additional embodiments, the recombinant amylase is more stable at pH 6, than the amylase of SEQ ID NO: 18, 40, 156, 174, 276, 308, 422, 456, 546, 632, 664, 780, 988, 1104, 1122, 1224, 1256, 1370, 1404, 1494, 1580, 1612, and/or 1728. In some further embodiments, the recombinant amylase is more stable at pHs less than 5, than the amylase of SEQ ID NO: 2. In some additional embodiments, the recombinant amylase is more stable at pH 5, than the amylase of SEQ ID NO: 2. In some additional embodiments, the recombinant amylase is more stable at pH 5, than the amylase of SEQ ID NO: 18, 40, 156, 174, 276, 308, 422, 456, 546, 632, 664, 780, 988, 1104, 1122, 1224, 1256, 1370, 1404, 1494, 1580, 1612, and/or 1728. In some further embodiments, the recombinant amylase is more stable at pH 4, than the amylase of SEQ ID NO: 2. In some further embodiments, the recombinant amylase is more stable at pH 5, than the amylase of SEQ ID NO: 18, 40, 156, 174, 276, 308, 422, 456, 546, 632, 664, 780, 988, 1104, 1122, 1224, 1256, 1370, 1404, 1494, 1580, 1612, and/or 1728. In some additional embodiments, the recombinant amylase is more stable at pH 3.8, than the amylase of SEQ ID NO: 2. In some additional embodiments, the recombinant amylase is more stable at pH 3.8, than the amylase of SEQ ID NO: 18, 40, 156, 174, 276, 308, 422, 456, 546, 632, 664, 780, 988, 1104, 1122, 1224, 1256, 1370, 1404, 1494, 1580, 1612, and/or 1728.

[0029] In some additional embodiments, the recombinant amylase is more stable at pH 3.5, than the amylase of SEQ ID NO: 2. In some additional embodiments, the recombinant amylase is more stable at pH 3.5, than the amylase of SEQ ID NO: 18, 40, 156, 174, 276, 308, 422, 456, 546, 632, 664, 780, 988, 1104, 1122, 1224, 1256, 1370, 1404, 1494, 1580, 1612, and/or 1728. In some additional embodiments, the recombinant amylase is more stable at pH 3.25, than the amylase of SEQ ID NO: 2. In some additional embodiments, the recombinant amylase is more stable at pH 3.25, than the amylase of SEQ ID NO: 18, 40, 156, 174, 276, 308, 422, 456, 546, 632, 664, 780, 988, 1104, 1122,

1224, 1256, 1370, 1404, 1494, 1580, 1612, and/or 1728. In some further embodiments, the recombinant amylase is more stable at pH 3, than the amylase of SEQ ID NO: 2. In some further embodiments, the recombinant amylase is more stable at pH 3, than the amylase of SEQ ID NO: 18, 40, 156, 174, 276, 308, 422, 456, 546, 632, 664, 780, 988, 1104, 1122, 1224, 1256, 1370, 1404, 1494, 1580, 1612, and/or 1728. In some additional embodiments, the recombinant amylase is more stable at pH 2.75, than the amylase of SEQ ID NO: 2. In some additional embodiments, the recombinant amylase is more stable at pH 2.75, than the amylase of SEQ ID NO: 18, 40, 156, 174, 276, 308, 422, 456, 546, 632, 664, 780, 988, 1104, 1122, 1224, 1256, 1370, 1404, 1494, 1580, 1612, and/or 1728. In some further embodiments, the recombinant amylase is more stable at pH 2.5, than the amylase of SEQ ID NO: 2. In some further embodiments, the recombinant amylase is more stable at pH 2.5, than the amylase of SEQ ID NO: 18, 40, 156, 174, 276, 308, 422, 456, 546, 632, 664, 780, 988, 1104, 1122, 1224, 1256, 1370, 1404, 1494, 1580, 1612, and/or 1728. In some further embodiments, the recombinant amylase is more stable at pH 2.3, than the amylase of SEQ ID NO: 2. In some further embodiments, the recombinant amylase is more stable at pH 2.3, than the amylase of SEQ ID NO: 18, 40, 156, 174, 276, 308, 422, 456, 546, 632, 664, 780, 988, 1104, 1122, 1224, 1256, 1370, 1404, 1494, 1580, 1612, and/or 1728. In some further embodiments, the recombinant amylase is more stable at pH 2, than the amylase of SEQ ID NO: 2. In some further embodiments, the recombinant amylase is more stable at pH 2, than the amylase of SEQ ID NO: 18, 40, 156, 174, 276, 308, 422, 456, 546, 632, 664, 780, 988, 1104, 1122, 1224, 1256, 1370, 1404, 1494, 1580, 1612, and/or 1728.

[0030] In some embodiments, the recombinant amylase is more resistant to proteolysis than the amylase of SEQ ID NO: 2. In some embodiments, the recombinant amylase is more resistant to proteolysis than the amylase of SEQ ID NO: 18, 40, 156, 174, 276, 308, 422, 456, 546, 632, 664, 780, 988, 1104, 1122, 1224, 1256, 1370, 1404, 1494, 1580, 1612, and/or 1728. In some embodiments, the recombinant amylase is resistant to proteolysis by pepsin. In some additional embodiments, the recombinant amylase is more resistant to proteolysis by pepsin than the amylase of SEQ ID NO: 2. In some embodiments, the recombinant amylase is more resistant to proteolysis by pepsin than the amylase of SEQ ID NO: 18, 40, 156, 174, 276, 308, 422, 456, 546, 632, 664, 780, 988, 1104, 1122, 1224, 1256, 1370, 1404, 1494, 1580, 1612, and/or 1728.

[0031] In some additional embodiments, the recombinant amylase is active in the presence of at least one bile salt. In some additional embodiments, the recombinant amylase is more active in the presence of at least one bile salt than the amylase of SEQ ID NO: 2. In some additional embodiments, the recombinant amylase is more active in the presence of at least one bile salt than the amylase of SEQ ID NO: 18, 40, 156, 174, 276, 308, 422, 456, 546, 632, 664, and/or 780, 988, 1104, 1122, 1224, 1256, 1370, 1404, 1494, 1580, 1612, and/or 1728. In some embodiments, the recombinant amylase retains enzymatic activity after exposure to a bile salt. In some additional embodiments, the recombinant amylase retains more enzymatic activity after exposure to a bile salt, as compared to a

reference sequence. In some embodiments, the reference sequence is the amylase of SEQ ID NO: 2, 18, 40, 156, 174, 276, 308, 422, 456, 546, 632, 664, 780, 988, 1104, 1122, 1224, 1256, 1370, 1404, 1494, 1580, 1612, and/or 1728. In some additional embodiments, the bile salt is taurocholate.

[0032] In yet some additional embodiments, the recombinant amylase exhibits more than one improved property, as compared to wild-type amylase or another recombinant amylase. In some embodiments, the recombinant amylase exhibits more than one improved property as compared to SEQ ID NO:2, while in some additional embodiments, the recombinant amylase exhibits more than one improved property as compared to SEQ ID NO: 18, 40, 156, 174, 276, 308, 422, 456, 546, 632, 664, 780, 988, 1104, 1122, 1224, 1256, 1370, 1404, 1494, 1580, 1612, and/or 1728. In some embodiments, the improved properties are selected from acid stability, alkaline stability, stability and/or activity at acidic pH, stability at alkaline pH, stability at neutral pH, thermostability, proteolysis resistance, autolysis resistance, and increased activity in the presence of at least one bile salt. In yet some additional embodiments, the recombinant amylase is more stable and/or active at acidic pHs, more thermostable, more resistant to proteolysis, and/or more active in the presence of at least one bile salt than the amylase of SEQ ID NO: 2, 18, 40, 156, 174, 276, 308, 422, 456, 546, 632, 664, 780, 988, 1104, 1122, 1224, 1256, 1370, 1404, 1494, 1580, 1612, and/or 1728. It is contemplated that any combination of improved properties will find use in the present invention. It is not intended that the present invention be limited to any specific combination of improved properties. Furthermore, in some embodiments, there are two improved properties, while in some other embodiments, there are three improved properties, in some additional embodiments, there are four improved properties, and in some additional embodiments, there are five or more improved properties. It is also contemplated that the recombinant amylase of the present invention furthers comprise additional improvements. In some embodiments, these additional improvements provide advantages over wild-type amylase, while in some other embodiments, the additional improvements will provide advantages over other recombinant amylases.

[0033] In some embodiments, the recombinant amylase exhibits at least one improved property selected from improved stability and/or activity at acidic pHs, improved thermostability, improved resistance to proteolysis, and/or improved activity in the presence of at least one bile salt, as compared to the amylase of SEQ ID NO: 2. In some embodiments, the recombinant amylase exhibits at least one improved property selected from improved stability and/or activity at acidic pHs, improved thermostability, improved resistance to proteolysis, and/or improved activity in the presence of at least one bile salt, as compared to the amylase of SEQ ID NO: 18, 40, 156, 174, 276, 308, 422, 456, 546, 632, 664, 780, 988, 1104, 1122, 1224, 1256, 1370, 1404, 1494, 1580, 1612, and/or 1728. In some embodiments, the recombinant amylase exhibits at least two improved properties selected from improved stability and/or activity at acidic pHs, improved thermostability, improved resistance to proteolysis, and/or improved activity in the presence of at least one bile salt, as compared to the

amylase of SEQ ID NO: 2. In some embodiments, the recombinant amylase exhibits at least two improved properties selected from improved stability and/or activity at acidic pHs, improved thermostability, improved resistance to proteolysis, and/or improved activity in the presence of at least one bile salt, as compared to the amylase of SEQ ID NO: 18, 40, 156, 174, 276, 308, 422, 456, 546, 632, 664, 780, 988, 1104, 1122, 1224, 1256, 1370, 1404, 1494, 1580, 1612, and/or 1728. In some embodiments, the recombinant amylase exhibits at least three improved properties selected from improved stability and/or activity at acidic pHs, improved thermostability, improved resistance to proteolysis, and/or improved activity in the presence of at least one bile salt, as compared to the amylase of SEQ ID NO: 2. In some embodiments, the recombinant amylase exhibits at least three improved properties selected from improved stability and/or activity at acidic pHs, improved thermostability, improved resistance to proteolysis, and/or improved activity in the presence of at least one bile salt, as compared to the amylase of SEQ ID NO: 18, 40, 156, 174, 276, 308, 422, 456, 546, 632, 664, 780, 988, 1104, 1122, 1224, 1256, 1370, 1404, 1494, 1580, 1612, and/or 1728. In some embodiments, the recombinant amylase exhibits the improved properties of improved stability and/or activity at acidic pHs, improved thermostability, improved resistance to proteolysis, and improved activity in the presence of at least one bile salt, as compared to the amylase of SEQ ID NO: 2. In some embodiments, the recombinant amylase exhibits the improved properties of improved stability and/or activity at acidic pHs, improved thermostability, improved resistance to proteolysis, and/or improved activity in the presence of at least one bile salt, as compared to the amylase of SEQ ID NO: 18, 40, 156, 174, 276, 308, 422, 456, 546, 632, 664, 780, 988, 1104, 1122, 1224, 1256, 1370, 1404, 1494, 1580, 1612, and/or 1728. In some embodiments, the recombinant amylase exhibits at least one improved property selected from improved stability and/or activity at acidic pHs, improved thermostability, improved resistance to proteolysis, and/or improved activity in the presence of at least one bile salt, as well as at least one additional improved property, as compared to the amylase of SEQ ID NO: 2. In some embodiments, the recombinant amylase exhibits at least one improved property selected from improved stability and/or activity at acidic pHs, improved thermostability, improved resistance to proteolysis, and/or improved activity in the presence of at least one bile salt, as well as at least one additional improved property, as compared to the amylase of SEQ ID NO: 18, 40, 156, 174, 276, 308, 422, 456, 546, 632, 664, 780, 988, 1104, 1122, 1224, 1256, 1370, 1404, 1494, 1580, 1612, and/or 1728. In some embodiments, the recombinant amylase exhibits at least one improved property selected from: i) enhanced catalytic activity; ii) increased tolerance to acid pH; iii) increased tolerance to pH 2.3, 2.5, 2.75, 3, 3.25, and/or 3.5; iv) increased tolerance to pH 6.7 and/or 6.8; v) increased tolerance to at least one protease; vi) increased tolerance to at least one bile salt; vii) increased thermotolerance; or a combination of any of i), ii), iii), iv), v), vi), and vii) as compared to a reference sequence. In some embodiments, the reference sequence is SEQ ID NO: 2, while in some alternative embodiments, the reference sequence is selected from SEQ ID NO: 18, 40, 156, 174, 276, 308, 422, 456, 546, 632, 664, 780, 988, 1104, 1122, 1224, 1256, 1370, 1404, 1494, 1580, 1612, and/or 1728. In

some embodiments, the recombinant amylase exhibits at least one improved property selected from: i) enhanced catalytic activity; ii) increased tolerance to acid pH; iii) increased tolerance to pH 2.3, 2.5, 2.75, 3, 3.25, and/or 3.5; iv) increased tolerance to pH 6.7 and/or 6.8; v) increased tolerance to at least one protease; vi) increased tolerance to at least one bile salt; vii) increased thermotolerance; or a combination of any of i), ii), iii), iv), v), vi), and vii) as compared to at least one reference sequence. In some embodiments, the reference sequence is SEQ ID NO: 2, while in some alternative embodiments, the reference sequence is selected from SEQ ID NO: 18, 40, 156, 174, 276, 308, 422, 456, 546, 632, 664, 780, 988, 1104, 1122, 1224, 1256, 1370, 1404, 1494, 1580, 1612, and/or 1728. In some embodiments, the recombinant amylase exhibits at least one improved property selected from: i) enhanced catalytic activity; ii) increased tolerance to acid pH; iii) increased tolerance to pH 2.3, 2.5, 2.75, 3, 3.25, and/or 3.5; iv) increased tolerance to pH 6.7 and/or 6.8; v) increased tolerance to at least one protease; vi) increased tolerance to at least one bile salt; vii) increased thermotolerance; or a combination of any of i), ii), iii), iv), v), vi), and vii) as compared to at least two or more reference sequences. In some embodiments, the reference sequence is selected from SEQ ID NO: 18, 40, 156, 174, 276, 308, 422, 456, 546, 632, 664, 780, 988, 1104, 1122, 1224, 1256, 1370, 1404, 1494, 1580, 1612, and/or 1728. In some embodiments, the protease is selected from pepsin, trypsin, and/or chymotrypsin. In some embodiments, the increased thermotolerance is measured at 30°C, 37°C, 40°C, 50°C, 60°C, and/or 95°C, and/or 40°C to 60°C. In some further embodiments, the recombinant amylase is purified.

[0034] In still some further embodiments, the amylase is stable in food and/or beverages. In some additional embodiments, the amylase is stable in nutritional and other supplements. In some embodiments, the supplements are liquid, while in other embodiments, they are emulsions, suspensions, or solids. It is not intended that the present invention be limited to any particular food, beverage, and/or supplement format or form.

[0035] The present invention also provides recombinant polynucleotide sequences encoding at least one recombinant amylase provided herein. In some embodiments, the recombinant polynucleotide sequence is codon-optimized. In some further embodiments, the recombinant polynucleotide comprises a sequence having at least about 85%, about 86%, about 87%, about 88%, about 89%, about 90%, about 91%, about 92%, about 93%, about 94%, about 95%, about 96%, about 97%, about 98%, about 99%, or more sequence identity to at least one sequence set forth in the odd-numbered sequences of SEQ ID NOS: 3-17, 21-965, and 969-1913. In some further embodiments, the polynucleotide comprises a sequence having at least 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99%, or more sequence identity to at least one sequence set forth in the odd-numbered sequences of SEQ ID NOS: 3-17, 21-965, and 969-1913. In some additional embodiments, the present invention provides at least one sequence set forth in the odd-numbered sequences of SEQ ID NOS: 3-17, 21-965, and 969-1913. In some additional embodiments, the

recombinant polynucleotide sequence comprises a sequence selected from the odd-numbered sequences of SEQ ID NOS: 3-17, 21-965, and 969-1913. In some embodiments, the recombinant polynucleotide sequence comprises a sequence selected from the odd-numbered sequences of SEQ ID NOS: 3-17, 21-965, and 969-1913, wherein said sequence encodes a recombinant polypeptide provided herein. In some embodiments, the recombinant polynucleotide sequence comprises a sequence selected from the odd-numbered sequences of SEQ ID NOS: 3-17, 21-965, and 969-1913, wherein said sequence encodes a recombinant polypeptide provided in an even-numbered sequence of SEQ ID NOS: 4-18, 22-966, and 970-1914. In some further embodiments, the recombinant polynucleotide encoding a recombinant amylase provided herein comprises a sequence having at least about 85%, about 86%, about 87%, about 88%, about 89%, about 90%, about 91%, about 92%, about 93%, about 94%, about 95%, about 96%, about 97%, about 98%, about 99%, or more sequence identity to at least one sequence set forth in the odd-numbered sequences of SEQ ID NOS: 3-17, 21-965, and 969-1913. In some further embodiments, the recombinant polynucleotide encoding a recombinant amylase provided herein comprises a sequence having at least 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99%, or more sequence identity to at least one sequence set forth in the odd-numbered sequences of SEQ ID NOS: 3-17, 21-965, and 969-1913. In some further embodiments, the recombinant polynucleotide encoding a recombinant amylase provided herein comprises a sequence having at least 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99%, or more sequence identity to at least one sequence set forth in the odd-numbered sequences of SEQ ID NOS: 3-17, 21-965, and 969-1913, wherein the recombinant amylase comprises a polypeptide sequence comprising an even-numbered sequence provided in SEQ ID NOS: 4-18, 22-966, and 970-1914.

[0036] The present invention also provides expression vectors comprising at least one recombinant polynucleotide sequence provided herein. The present invention also provides expression vectors comprising at least one recombinant polynucleotide sequence encoding at least one recombinant amylase provided herein. In some additional embodiments, the recombinant polynucleotide sequence is operably linked to a control sequence. In some embodiments, the control sequence is a promoter. In some further embodiments, the promoter is a heterologous promoter.

[0037] The present invention also provides host cells comprising at least one expression vector provided herein. The present invention also provides host cells comprising at least one expression vector comprising at least one recombinant polynucleotide sequence encoding at least one recombinant amylase provided herein. The present invention also provides host cells comprising an expression vector comprising at least one recombinant polynucleotide sequence encoding at least one recombinant amylase provided herein. The present invention also provides host cells comprising an expression vector comprising at least one recombinant polynucleotide sequence encoding a recombinant amylase provided herein. In some embodiments, the host cell is eukaryotic, while in

some alternative embodiments, the host cell is prokaryotic. In some embodiments, the host cell is *Escherichia coli*. In some alternative embodiments, the host cell is *Saccharomyces cerevisiae*.

[0038] The present invention also provides methods of producing at least one recombinant amylase, comprising culturing at least one host cell provided herein, under conditions that the recombinant amylase encoded by the recombinant polynucleotide is produced. In some embodiments, the methods further comprise the step of recovering the amylase. In yet some additional embodiments, the methods further comprise the step of purifying the amylase.

[0039] The present invention also provides compositions comprising at least one recombinant amylase provided herein. In some embodiments, the composition comprising at least one recombinant amylase comprises a pharmaceutical composition. In some additional embodiments, the pharmaceutical composition is suitable for the treatment of pancreatic insufficiency. In some additional embodiments, the pharmaceutical composition further comprising a pharmaceutically acceptable carrier and/or excipient. In some embodiments, the pharmaceutical composition is suitable for parenteral injection or infusion, subcutaneous injection, inhalation, and/or dermal application to a human. In some embodiments, the pharmaceutical composition is suitable for oral administration to a human. In some embodiments, the pharmaceutical composition further comprises an enteric coating.

[0040] In some additional embodiments, the pharmaceutical composition further comprises at least one lipase. In some further embodiments, the pharmaceutical composition further comprises at least one protease. In yet some additional embodiments, the pharmaceutical composition further comprises at least one protease and at least one lipase. In some embodiments, the pharmaceutical composition further comprises a pancreatic extract comprising lipase, protease, and amylase activity. The present invention also provides compositions comprising at least one recombinant amylase provided herein, wherein the compositions are suitable for other uses.

[0041] The present invention also provides methods for treating and/or preventing the symptoms of pancreatic insufficiency in a subject, comprising providing a subject having pancreatic insufficiency, and providing the pharmaceutical composition provided herein to the subject. In some embodiments, the symptoms of pancreatic insufficiency are ameliorated in a subject, upon the administration of the composition comprising at least one recombinant amylase to the subject. In some further embodiments, the subject is able to eat a diet that is less restricted in its carbohydrate content (e.g., starches) than diets required by subjects exhibiting the symptoms of pancreatic insufficiency. In some additional embodiments, the subject is a human patient. In some embodiments, the human patient is an infant, while in some other embodiments, the human patient is a child. In yet some further embodiments, the human patient is an adult, while in some alternative embodiments, the human patient is a young adult. The some embodiments, the subject is a non-human mammal, such as a non-human primate, pigs, cows, dogs, and cats. The present invention further provides medicaments

comprising at least one recombinant amylase provided herein. The present invention also provides for use of the compositions comprising at least one recombinant amylase provided herein.

[0042] The present invention further provides methods for starch hydrolysis, comprising providing starch and at least one engineered amylase provided herein; and exposing the starch to the engineered amylase under conditions such that the starch is hydrolyzed by said engineered amylase. In some embodiments, the present invention provides methods for starch hydrolysis comprising providing starch and a composition comprising at least one engineered amylase, and exposing said starch to said composition under conditions such that said starch is hydrolyzed by said engineered amylase of said composition.

DESCRIPTION OF THE INVENTION

[0043] The present invention provides engineered amylase polypeptides and compositions thereof. The engineered amylase polypeptides have been optimized to provide improved thermostability, protease stability, and stability under a range of pH conditions, including acidic (pH <7) conditions. The invention also relates to the use of the compositions comprising the engineered amylase polypeptides for therapeutic and/or nutritional purposes. In some embodiments, the amylase variants of the present invention find use in PERT treatment of PEI conditions. In some additional embodiments, the amylase is administered in formats that do not require an enteric coating and/or proton-pump inhibitors (PPIs). The present invention also provides polynucleotides encoding the engineered amylase polypeptides, as well as methods for making the engineered polynucleotides and amylase polypeptides.

Abbreviations and Definitions

[0044] Unless defined otherwise, all technical and scientific terms used herein generally have the same meaning as commonly understood by one of ordinary skill in the art to which this invention pertains. Generally, the nomenclature used herein and the laboratory procedures of cell culture, molecular genetics, microbiology, biochemistry, organic chemistry, analytical chemistry and nucleic acid chemistry described below are those well-known and commonly employed in the art. Such techniques are well-known and described in numerous texts and reference works well known to those of skill in the art. Standard techniques, or modifications thereof, are used for chemical syntheses and chemical analyses. All patents, patent applications, articles and publications mentioned herein, both *supra* and *infra*, are hereby expressly incorporated herein by reference.

[0045] Although any suitable methods and materials similar or equivalent to those described herein find use in the practice of the present invention, some methods and materials are described herein. It is to be understood that this invention is not limited to the particular methodology, protocols, and reagents described, as these may vary, depending upon the context they are used by those of skill in the art. Accordingly, the terms defined immediately below are more fully described by reference to

the application as a whole. All patents, patent applications, articles and publications mentioned herein, both *supra* and *infra*, are hereby expressly incorporated herein by reference.

[0046] As used herein, the singular "a", "an," and "the" include the plural references, unless the context clearly indicates otherwise.

[0047] Numeric ranges are inclusive of the numbers defining the range. Thus, every numerical range disclosed herein is intended to encompass every narrower numerical range that falls within such broader numerical range, as if such narrower numerical ranges were all expressly written herein. It is also intended that every maximum (or minimum) numerical limitation disclosed herein includes every lower (or higher) numerical limitation, as if such lower (or higher) numerical limitations were expressly written herein.

[0048] As used herein, the term "about" means an acceptable error for a particular value. In some instances, "about" means within 0.05%, 0.5%, 1.0%, or 2.0%, of a given value range. In some instances, "about" means within 1, 2, 3, or 4 standard deviations of a given value.

[0049] Furthermore, the headings provided herein are not limitations of the various aspects or embodiments of the invention which can be had by reference to the application as a whole. Accordingly, the terms defined immediately below are more fully defined by reference to the application as a whole. Nonetheless, in order to facilitate understanding of the invention, a number of terms are defined below.

[0050] Unless otherwise indicated, nucleic acids are written left to right in 5' to 3' orientation; amino acid sequences are written left to right in amino to carboxy orientation, respectively.

[0051] As used herein, the term "comprising" and its cognates are used in their inclusive sense (*i.e.*, equivalent to the term "including" and its corresponding cognates).

[0052] As used herein, "EC" number refers to the Enzyme Nomenclature of the Nomenclature Committee of the International Union of Biochemistry and Molecular Biology (NC-IUBMB). The IUBMB biochemical classification is a numerical classification system for enzymes based on the chemical reactions they catalyze.

[0053] As used herein "ATCC" refers to the American Type Culture Collection whose biorepository collection includes genes and strains.

[0054] As used herein "NCBI" refers to National Center for Biological Information and the sequence databases provided therein.

[0055] As used herein, "amylase" refers to an enzyme that is capable of hydrolyzing starch to produce glucose and maltose.

[0056] As used herein, "protease" (and "proteinase" and "peptidase") refers to the numerous enzymes that hydrolyze proteins. There are numerous proteases involved in the breakdown of proteins into smaller polypeptide unties or single amino acids. Proteases are important for numerous biological functions, including digestion of ingested proteins, protein catabolism, and cell signaling.

[0057] As used herein, "lipase" refers to any enzyme commonly referred to as "lipase," that catalyzes the hydrolysis of fats by hydrolyzing the ester bonds of triglycerides. Pancreatic lipases are important in the breakdown of fats to fatty acids, glycerol, and other alcohols. Lipases are essential in the digestion, transport, and processing of dietary lipids in most organisms.

[0058] As used herein, the term "lipid" refers to a class of water-insoluble macromolecules that include fatty acids and their esters, sterols, prenols, certain poorly soluble vitamins, and other related compounds. "Fats" are a subset of lipids composed of fatty acid esters (e.g., triglycerides, which are made from glycerol and three fatty acids). It is not intended that the present invention be limited to any specific lipid and/or fat. Taking the context into consideration, the terms "fat" and "lipid" are used interchangeably herein.

[0059] As used herein, the terms "protein," "polypeptide," and "peptide" are used interchangeably to denote a polymer of at least two amino acids covalently linked by an amide bond, regardless of length or post-translational modification (e.g., glycosylation or phosphorylation).

[0060] As used herein, the term "amino acids" are referred to herein by either their commonly known three-letter symbols or by the one-letter symbols recommended by IUPAC-IUB Biochemical Nomenclature Commission. Nucleotides, likewise, may be referred to by their commonly accepted single letter codes.

[0061] As used herein, the term "engineered," "recombinant," "non-naturally occurring," and "variant," when used with reference to a cell, a polynucleotide or a polypeptide refers to a material or a material corresponding to the natural or native form of the material that has been modified in a manner that would not otherwise exist in nature or is identical thereto but produced or derived from synthetic materials and/or by manipulation using recombinant techniques.

[0062] Recombinant polypeptides can be produced using any suitable methods known the art. Genes encoding the wild-type polypeptide of interest can be cloned in vectors, such as plasmids, and expressed in desired hosts, such as *E. coli, S. cerevisiae,* etc. Variants of recombinant polypeptides can be generated by various methods known in the art. Indeed, there is a wide variety of different mutagenesis techniques well known to those skilled in the art. In addition, mutagenesis kits are also available from many commercial molecular biology suppliers. Methods are available to make specific substitutions at defined amino acids (site-directed), specific or random mutations in a localized region of the gene (regio-specific), or random mutagenesis over the entire gene (*e.g.*, saturation mutagenesis). Numerous suitable methods are known to those in the art to generate

enzyme variants, including but not limited to site-directed mutagenesis of single-stranded DNA or double-stranded DNA using PCR, cassette mutagenesis, gene synthesis, error-prone PCR, shuffling, and chemical saturation mutagenesis, or any other suitable method known in the art. Non-limiting examples of methods used for DNA and protein engineering are provided in the following patents: US Pat. No. 6,117,679; US Pat. No. 6,420,175; US Pat. No. 6,376,246; US Pat. No. 6,586,182; US Pat. No. 7,747,391; US Pat. No. 7,747,393; US Pat. No. 7,783,428; and US Pat. No. 8,383,346. After the variants are produced, they can be screened for any desired property (e.g., high or increased activity, or low or reduced activity, increased thermal activity, increased thermal stability, and/or acidic pH stability, etc.). In some embodiments, "recombinant amylase polypeptides" (also referred to herein as "engineered amylase polypeptides," "variant amylase enzymes," and "amylase variants") find use.

[0063] As used herein, "wild-type" and "naturally-occurring" refer to the form found in nature. For example, a wild-type polypeptide or polynucleotide sequence is a sequence present in an organism that can be isolated from a source in nature and which has not been intentionally modified by human manipulation.

[0064] As used herein, "coding sequence" refers to that part of a nucleic acid (e.g., a gene) that encodes an amino acid sequence of a protein.

[0065] The term "percent (%) sequence identity" is used herein to refer to comparisons among polynucleotides and polypeptides, and are determined by comparing two optimally aligned sequences over a comparison window, wherein the portion of the polynucleotide or polypeptide sequence in the comparison window may comprise additions or deletions (i.e., gaps) as compared to the reference sequence for optimal alignment of the two sequences. The percentage may be calculated by determining the number of positions at which the identical nucleic acid base or amino acid residue occurs in both sequences to yield the number of matched positions, dividing the number of matched positions by the total number of positions in the window of comparison and multiplying the result by 100 to yield the percentage of sequence identity. Alternatively, the percentage may be calculated by determining the number of positions at which either the identical nucleic acid base or amino acid residue occurs in both sequences or a nucleic acid base or amino acid residue is aligned with a gap to yield the number of matched positions, dividing the number of matched positions by the total number of positions in the window of comparison and multiplying the result by 100 to yield the percentage of sequence identity. Those of skill in the art appreciate that there are many established algorithms available to align two sequences. Optimal alignment of sequences for comparison can be conducted, e.g., by the local homology algorithm of Smith and Waterman (Smith and Waterman, Adv. Appl. Math., 2:482 [1981]), by the homology alignment algorithm of Needleman and Wunsch (Needleman and Wunsch, J. Mol. Biol., 48:443 [1970), by the search for similarity method of Pearson and Lipman (Pearson and Lipman, Proc. Natl. Acad. Sci. USA 85:2444 [1988]), by computerized implementations of these algorithms (e.g., GAP, BESTFIT, FASTA, and TFASTA in the GCG Wisconsin Software

Package), or by visual inspection, as known in the art. Examples of algorithms that are suitable for determining percent sequence identity and sequence similarity include, but are not limited to the BLAST and BLAST 2.0 algorithms, which are described by Altschul et al. (See, Altschul et al., J. Mol. Biol., 215: 403-410 [1990]; and Altschul et al., Nucleic Acids Res., 3389-3402 [1977], respectively). Software for performing BLAST analyses is publicly available through the National Center for Biotechnology Information website. This algorithm involves first identifying high scoring sequence pairs (HSPs) by identifying short words of length W in the query sequence, which either match or satisfy some positive-valued threshold score T when aligned with a word of the same length in a database sequence. T is referred to as, the neighborhood word score threshold (See, Altschul et al., supra). These initial neighborhood word hits act as seeds for initiating searches to find longer HSPs containing them. The word hits are then extended in both directions along each sequence for as far as the cumulative alignment score can be increased. Cumulative scores are calculated using, for nucleotide sequences, the parameters M (reward score for a pair of matching residues; always >0) and N (penalty score for mismatching residues; always <0). For amino acid sequences, a scoring matrix is used to calculate the cumulative score. Extension of the word hits in each direction are halted when: the cumulative alignment score falls off by the quantity X from its maximum achieved value; the cumulative score goes to zero or below, due to the accumulation of one or more negative-scoring residue alignments; or the end of either sequence is reached. The BLAST algorithm parameters W, T, and X determine the sensitivity and speed of the alignment. The BLASTN program (for nucleotide sequences) uses as defaults a wordlength (W) of 11, an expectation (E) of 10, M=5, N=-4, and a comparison of both strands. For amino acid sequences, the BLASTP program uses as defaults a wordlength (W) of 3, an expectation (E) of 10, and the BLOSUM62 scoring matrix (See, Henikoff and Henikoff, Proc. Natl. Acad. Sci. USA 89:10915 [1989]). Exemplary determination of sequence alignment and % sequence identity can employ the BESTFIT or GAP programs in the GCG Wisconsin Software package (Accelrys, Madison WI), using default parameters provided.

[0066] As used herein, "reference sequence" refers to a defined sequence used as a basis for a sequence comparison. A reference sequence may be a subset of a larger sequence, for example, a segment of a full-length gene or polypeptide sequence. Generally, a reference sequence is at least 20 nucleotide or amino acid residues in length, at least 25 residues in length, at least 50 residues in length, at least 100 residues in length or the full length of the nucleic acid or polypeptide. Since two polynucleotides or polypeptides may each (1) comprise a sequence (*i.e.*, a portion of the complete sequence) that is similar between the two sequences, and (2) may further comprise a sequence that is divergent between the two sequences, sequence comparisons between two (or more) polynucleotides or polypeptide are typically performed by comparing sequences of the two polynucleotides or polypeptides over a "comparison window" to identify and compare local regions of sequence similarity. In some embodiments, a "reference sequence" can be based on a primary amino acid

sequence, where the reference sequence is a sequence that can have one or more changes in the primary sequence. "Comparison window" refers to a conceptual segment of at least about 20 contiguous nucleotide positions or amino acids residues wherein a sequence may be compared to a reference sequence of at least 20 contiguous nucleotides or amino acids and wherein the portion of the sequence in the comparison window may comprise additions or deletions (i.e., gaps) of 20 percent or less as compared to the reference sequence (which does not comprise additions or deletions) for optimal alignment of the two sequences. The comparison window can be longer than 20 contiguous residues, and includes, optionally 30, 40, 50, 100, or longer windows.

[0067] "Corresponding to", "reference to" or "relative to" when used in the context of the numbering of a given amino acid or polynucleotide sequence refers to the numbering of the residues of a specified reference sequence when the given amino acid or polynucleotide sequence is compared to the reference sequence. In other words, the residue number or residue position of a given polymer is designated with respect to the reference sequence rather than by the actual numerical position of the residue within the given amino acid or polynucleotide sequence. For example, a given amino acid sequence, such as that of an engineered amylase, can be aligned to a reference sequence by introducing gaps to optimize residue matches between the two sequences. In these cases, although the gaps are present, the numbering of the residue in the given amino acid or polynucleotide sequence is made with respect to the reference sequence to which it has been aligned.

[0068] As used herein, "mutation" refers to any change in a polypeptide or polynucleotide sequence. It is intended to encompass any number (i.e., one or more) of substitutions, insertions, deletions, and/or rearrangements present in a sequence (i.e., as compared to the starting or reference sequence). Thus, mutations in sequences result in the production of variant polypeptides (e.g., variant or recombinant amylases), as provided herein.

[0069] As used herein, "amino acid difference" or "residue difference" refers to a difference in the amino acid residue at a position of a polypeptide sequence relative to the amino acid residue at a corresponding position in a reference sequence. The positions of amino acid differences generally are referred to herein as "Xn," where n refers to the corresponding position in the reference sequence upon which the residue difference is based. For example, a "residue difference at position X92 as compared to SEQ ID NO: 2" refers to a difference of the amino acid residue at the polypeptide position corresponding to position 92 of SEQ ID NO: 2. Thus, if the reference polypeptide of SEQ ID NO: 2 has a threonine at position 92, then a "residue difference at position X92 as compared to SEQ ID NO:2" means there is an amino acid residue other than threonine at the position of the polypeptide corresponding to position 92 of SEQ ID NO: 2 (e.g., T92A). In most instances herein, the specific amino acid residue difference at a position is indicated as "XnY" where "Xn" specified the corresponding position as described above, and "Y" is the single letter identifier of the amino acid found in the engineered polypeptide (i.e., the different residue than in the reference polypeptide). In

some instances (e.g., in Table 4-1, 4-2, 4-3, 4-4, 4-5, 4-6, 4-7, 4-8, 4-9, 4-10, 4-11, 4-12, 4-13, and/or 4-14), the present disclosure also provides specific amino acid differences denoted by the conventional notation "AnB", where A is the single letter identifier of the residue in the reference sequence, "n" is the number of the residue position in the reference sequence, and B is the single letter identifier of the residue substitution in the sequence of the engineered polypeptide. In some instances, a polypeptide of the present disclosure can include one or more amino acid residue differences relative to a reference sequence, which is indicated by a list of the specified positions where residue differences are present relative to the reference sequence. In some embodiments, where more than one amino acid can be used in a specific residue position of a polypeptide, the various amino acid residues that can be used are separated by a "/" (e.g., X446A/X446G/X446M or X446A/G/M or P446A/G/M). In some embodiments, the enzyme variants comprise more than one substitution. These substitutions are separated by a slash for ease in reading (e.g., V408A/M439S). The present application includes engineered polypeptide sequences comprising one or more amino acid differences that include either/or both conservative and non-conservative amino acid substitutions.

[0070] As used herein, "conservative amino acid substitution" refers to a substitution of a residue with a different residue having a similar side chain, and thus typically involves substitution of the amino acid in the polypeptide with amino acids within the same or similar defined class of amino acids. By way of example and not limitation, an amino acid with an aliphatic side chain may be substituted with another aliphatic amino acid (e.g., alanine, valine, leucine, and isoleucine); an amino acid with hydroxyl side chain is substituted with another amino acid with a hydroxyl side chain (e.g., serine and threonine); an amino acids having aromatic side chains is substituted with another amino acid having an aromatic side chain (e.g., phenylalanine, tyrosine, tryptophan, and histidine); an amino acid with a basic side chain is substituted with another amino acid with a basis side chain (e.g., lysine and arginine); an amino acid with an acidic side chain is substituted with another amino acid with an acidic side chain (e.g., aspartic acid or glutamic acid); and/or a hydrophobic or hydrophilic amino acid is replaced with another hydrophobic or hydrophilic amino acid, respectively.

[0071] As used herein, "non-conservative substitution" refers to substitution of an amino acid in the polypeptide with an amino acid with significantly differing side chain properties. Non-conservative substitutions may use amino acids between, rather than within, the defined groups and affects (a) the structure of the peptide backbone in the area of the substitution (e.g., proline for glycine) (b) the charge or hydrophobicity, or (c) the bulk of the side chain. By way of example and not limitation, an exemplary non-conservative substitution can be an acidic amino acid substituted with a basic or aliphatic amino acid; an aromatic amino acid substituted with a small amino acid; and a hydrophilic amino acid substituted with a hydrophobic amino acid.

[0072] As used herein, "deletion" refers to modification to the polypeptide by removal of one or more amino acids from the reference polypeptide. Deletions can comprise removal of 1 or more

amino acids, 2 or more amino acids, 5 or more amino acids, 10 or more amino acids, 15 or more amino acids, or 20 or more amino acids, up to 10% of the total number of amino acids, or up to 20% of the total number of amino acids making up the reference enzyme while retaining enzymatic activity and/or retaining the improved properties of an engineered enzyme. Deletions can be directed to the internal portions and/or terminal portions of the polypeptide. In various embodiments, the deletion can comprise a continuous segment or can be discontinuous.

[0073] As used herein, "insertion" refers to modification to the polypeptide by addition of one or more amino acids from the reference polypeptide. Insertions can be in the internal portions of the polypeptide, or to the carboxy or amino terminus. Insertions as used herein include fusion proteins as is known in the art. The insertion can be a contiguous segment of amino acids or separated by one or more of the amino acids in the naturally occurring polypeptide.

[0074] As used herein, an asterisk (*) used in the context of a polynucleotide sequence indicates the presence of a stop codon within the polynucleotide sequence. In some embodiments, the variant amylases are truncated, as compared to the starting or reference sequence, due to the presence of stop codons.

[0075] A "functional fragment" and a "biologically active fragment" are used interchangeably herein refers to a polypeptide that has an amino-terminal and/or carboxy-terminal deletion(s) and/or internal deletions (e.g., the sequence is truncated), but where the remaining amino acid sequence is identical to the corresponding positions in the sequence to which it is being compared (e.g., a full-length engineered amylase of the present invention) and that retains substantially all of the activity of the full-length polypeptide.

[0076] As used herein, "isolated polypeptide" refers to a polypeptide that is substantially separated from other contaminants that naturally accompany it (e.g., protein, lipids, and polynucleotides). The term embraces polypeptides that have been removed or purified from their naturally-occurring environment or expression system (e.g., host cell or *in vitro* synthesis). The recombinant amylase polypeptides may be present within a cell, present in the cellular medium, or prepared in various forms, such as lysates or isolated preparations. As such, in some embodiments, the recombinant amylase polypeptides can be an isolated polypeptide.

[0077] The terms "isolated" and "purified" are used to refer to a molecule (e.g., an isolated nucleic acid, polypeptide, etc.) or other component that is removed from at least one other component with which it is naturally associated. The term "purified" does not require absolute purity, rather it is intended as a relative definition.

[0078] As used herein, "substantially pure polypeptide" refers to a composition in which the polypeptide species is the predominant species present (i.e., on a molar or weight basis it is more abundant than any other individual macromolecular species in the composition), and is generally a

substantially purified composition when the object species comprises at least about 50 percent of the macromolecular species present by mole or % weight. Generally, a substantially pure amylase composition comprises about 60% or more, about 70% or more, about 80% or more, about 90% or more, about 95% or more, and about 98% or more of all macromolecular species by mole or % weight present in the composition. In some embodiments, the object species is purified from a starting preparation to essential homogeneity (i.e., contaminant species cannot be detected in the composition by conventional detection methods) wherein the composition consists essentially of a single macromolecular species. Solvent species, small molecules (<500 Daltons), and elemental ion species are not considered macromolecular species. In some embodiments, the isolated recombinant amylase polypeptides are substantially pure polypeptide compositions. In some embodiments, substantially pure recombinant amylase polypeptide preparations added to formulations suitable for use in the present invention (e.g., polysaccharides, surfactants, etc.).

[0079] As used herein, an "improved enzyme property" and "improved property" refers to a property of an engineered amylase polypeptide which comprises an improvement in any enzyme property as compared to a reference amylase polypeptide and/or as a wild-type amylase polypeptide or another engineered amylase polypeptide. Improved properties include but are not limited to such properties as increased protein expression, increased thermoactivity, increased thermostability, increased pH activity, increased stability, increased enzymatic activity, increased substrate specificity or affinity, increased specific activity, increased resistance to substrate or end-product inhibition, increased chemical stability, improved chemoselectivity, improved solvent stability, increased tolerance to acidic or basic pH, increased tolerance to proteolytic activity (i.e., reduced sensitivity to proteolysis), reduced aggregation, increased solubility, reduced immunogenicity, improved post-translational modification (e.g., glycosylation), and altered temperature profile.

[0080] As used herein, "increased enzymatic activity" or "enhanced catalytic activity" refers to an improved property of the engineered amylase polypeptides, that can be represented by an increase in specific activity (e.g., product produced/time/weight protein) or an increase in percent conversion of the substrate to the product (e.g., percent conversion of starting amount of substrate to product in a specified time period using a specified amount of amylase) as compared to the reference amylase enzyme. Exemplary methods to determine enzyme activity are provided in the Examples. Any property relating to enzyme activity may be affected, including the classical enzyme properties of K_m, V_{max} or k_{cat}, changes of which can lead to increased enzymatic activity. Improvements in enzyme activity can be from about 1.1 fold the enzymatic activity of the corresponding wild-type enzyme, to as much as 2-fold, 5-fold, 10-fold, 20-fold, 25-fold, 50-fold, 75-fold, 100-fold, 150-fold, 200-fold or more enzymatic activity than the naturally occurring amylase or another engineered amylase from which the amylase polypeptides were derived.

[0081] Amylase activity can be measured by any suitable method known in the art (e.g., standard assays, such as monitoring changes in spectrophotometric properties of reactants or products). In some embodiments, the amount of products produced can be measured by using ethylidene pNP-G7 as a substrate and monitoring the p-nitrophenol released by monitoring absorbance at A405. In some embodiments, starch can be used as the substrate, and the amount of maltose produced can be measured with the dinitrosalicylic acid assay and monitoring absorbance at 540nm, while in some other embodiments, the products can be measured using alternative methods known in the art. Comparisons of enzyme activities are made using a defined preparation of enzyme, a defined assay under a set condition, and one or more defined substrates, as further described in detail herein.

[0082] As used herein, the terms "protease stable" and "stability to proteolysis" refer to the ability of a protein (e.g., a recombinant amylase of the present invention) to function and withstand proteolysis mediated by any proteolytic enzyme or other proteolytic compound or factor and retain its function following treatment with the protease. It is not intended that the term be limited to the use of any particular protease to assess the stability of a protein. Indeed, the engineered amylases of the present invention are stable and retain enzymatic activity in the presence of various proteases. In some embodiments, the recombinant amylases of the present invention to function and withstand proteolysis mediated by any proteolytic enzyme or other proteolytic compound or factor and retain its function following exposure to a protease. In some embodiments, the engineered amylases are stable in the presence of trypsin, chymotrypsin, and/or pepsin. However, it is not intended that the present invention be limited to any specific protease or any particular method of assessing proteolytic stability.

[0083] As used herein, the term "pH stability" refers to the ability of a protein (e.g., a recombinant amylase of the present invention) to function after incubation at a particular pH. In some embodiments, the present invention provides recombinant amylases that are stable at a range of pHs, including, but not limited to the range of pH 2 to pH 7. In some embodiments, the recombinant amylases are stable at different pH ranges, as indicated in the Examples provided herein. It is not intended that the present invention be limited to any pH stability level nor pH range.

[0084] As used herein, the term "improved tolerance to acidic pH" means that a recombinant amylase according to the invention will have increased stability (higher retained activity at about pH 7, 6, 5, 4 3, 2, or even lower, after exposure to acidic pH for a specified period of time [e.g., 1 hour, up to 24 hours, etc.]) as compared to a reference amylase or another enzyme.

[0085] "Physiological pH" as used herein means the pH range generally found in a subject's (e.g., human) blood (e.g., pH 7.2 – 7.4).

[0086] The term "basic pH" (e.g., used with reference to improved stability to basic pH conditions or increased tolerance to basic pH) means a pH range of about 7 to 11, or in some embodiments, greater than pH 11.

[0087] The term "acidic pH" (e.g., used with reference to improved stability to acidic pH conditions or increased tolerance to acidic pH) means a pH range that encompasses any pH values less than 7. In some embodiments, the acid pH is less than 7, while in some other embodiments, the pH is less than about 6, 5, 4, 3, 2, or lower. In some alternative embodiments, the recombinant amylases of the present invention are stable at pH levels of 2 to 4. However, it is not intended that the present invention be limited to any specific pH value or range of values.

[0088] As used herein, the phrase "gastric challenge" refers to the exposure of the recombinant amylases of the present invention to a low pH environment and the presence of at least one enzyme (e.g., pepsin), such that the recombinant amylase is exposed to the conditions that may be encountered in the stomach (e.g., the human stomach).

[0089] As used herein, the phrase "intestinal challenge" refers to the exposure of the recombinant amylases of the present invention to a neutral pH environment and the presence of at least one protease (e.g., intestinal proteases such as trypsin and/or chymotrypsin) and/or at least one bile salt (e.g., sodium taurocholate), such that the recombinant lipase is exposed to the conditions that may be encountered in the intestinal tract (e.g., human intestines).

[0090] As used herein, the phrase "multiple challenges in sequence" refers to the exposure of the recombinant amylases of the present invention to a series of challenge conditions. For example, in some embodiments, a one hour heat challenge was followed by a one hour gastric challenge, and then followed by a one hour intestinal challenge. It is not intended that the present invention be limited to any specific challenges and/or challenge conditions or a specific sequence of challenges.

[0091] The terms "thermal stability" and "thermostability" refer to the ability of a protein (e.g., a recombinant amylase of the present invention) to function at a particular temperature. In some embodiments, the term refers to the ability of a protein to function following incubation at a particular temperature. In some embodiments, the recombinant amylases of the present invention are "thermotolerant" (i.e., the enzymes maintain their catalytic activity at elevated temperatures). In some embodiments, the recombinant amylases resist inactivation at elevated temperatures and in some embodiments, maintain catalytic activity at elevated temperatures for prolonged exposure times. These terms are used interchangeably herein. It is not intended that the present invention be limited to any specific temperature and/or exposure time. Such stability can be measured by any method known in the art (e.g., the methods described herein). It is not intended that the present invention be limited to any specific temperature stability level nor temperature range. In some embodiments, thermal

stability is measured following incubation of a protein (e.g., a recombinant amylase of the present invention) at a particular temperature.

[0092] As used herein, the term "chemical stability" refers to the ability of a protein (e.g., a recombinant amylase of the present invention) to function in the presence of a chemical that adversely affects the function of another protein. It is not intended that the present invention be limited to any specific chemical stability level nor range of chemical stabilities.

[0093] As used herein, the term "conversion" refers to the enzymatic conversion (or biotransformation) of a substrate(s) to the corresponding product(s). "Percent conversion" refers to the percent of the substrate that is converted to the product within a period of time under specified conditions. Thus, the "enzymatic activity" or "activity" of an amylase polypeptide can be expressed as "percent conversion" of the substrate to the product in a specific period of time.

[0094] As used herein, "hybridization stringency" relates to hybridization conditions, such as washing conditions, in the hybridization of nucleic acids. Generally, hybridization reactions are performed under conditions of lower stringency, followed by washes of varying but higher stringency. The term "moderately stringent hybridization" refers to conditions that permit target-DNA to bind a complementary nucleic acid that has about 60% identity, preferably about 75% identity, about 85% identity to the target DNA, with greater than about 90% identity to target-polynucleotide. Exemplary moderately stringent conditions are conditions equivalent to hybridization in 50% formamide, 5× Denhart's solution, 5×SSPE, 0.2% SDS at 42°C, followed by washing in 0.2×SSPE, 0.2% SDS, at 42°C. "High stringency hybridization" refers generally to conditions that are about 10°C or less from the thermal melting temperature T_m as determined under the solution condition for a defined polynucleotide sequence. In some embodiments, a high stringency condition refers to conditions that permit hybridization of only those nucleic acid sequences that form stable hybrids in 0.018M NaCl at 65°C (i.e., if a hybrid is not stable in 0.018M NaCl at 65°C, it will not be stable under high stringency conditions, as contemplated herein). High stringency conditions can be provided, for example, by hybridization in conditions equivalent to 50% formamide, 5× Denhart's solution, 5×SSPE, 0.2% SDS at 42°C, followed by washing in 0.1×SSPE, and 0.1% SDS at 65°C. Another high stringency condition is hybridizing in conditions equivalent to hybridizing in 5X SSC containing 0.1% (w:v) SDS at 65°C and washing in 0.1x SSC containing 0.1% SDS at 65°C. Other high stringency hybridization conditions, as well as moderately stringent conditions, are described in the references cited above.

[0095] As used herein, a "vector" is a DNA construct for introducing a DNA sequence into a cell. In some embodiments, the vector is an expression vector that is operably linked to a suitable control sequence capable of effecting the expression in a suitable host of the polypeptide encoded in the DNA sequence. In some embodiments, plasmids find use as vectors. In some embodiments, an "expression

vector" has a promoter sequence operably linked to the DNA sequence (e.g., transgene) to drive expression in a host cell, and in some embodiments, also comprises a transcription terminator sequence.

[0096] As used herein, "codon optimized" refers to changes in the codons of the polynucleotide encoding a protein to those preferentially used in a particular organism such that the encoded protein is more efficiently expressed in the organism of interest. Although the genetic code is degenerate in that most amino acids are represented by several codons, called "synonyms" or "synonymous" codons, it is well known that codon usage by particular organisms is nonrandom and biased towards particular codon triplets. This codon usage bias may be higher in reference to a given gene, genes of common function or ancestral origin, highly expressed proteins versus low copy number proteins, and the aggregate protein coding regions of an organism's genome. In some embodiments, the polynucleotides encoding the amylase enzymes may be codon optimized for optimal production from the host organism selected for expression.

[0097] As used herein, "control sequence" includes all components that are necessary or advantageous for the expression of a polynucleotide and/or polypeptide of the present application. Each control sequence may be native or foreign to the nucleic acid sequence encoding the polypeptide. Such control sequences include, but are not limited to, a leader, polyadenylation sequence, propeptide sequence, promoter sequence, signal peptide sequence, initiation sequence and transcription terminator. At a minimum, the control sequences include a promoter, and transcriptional and translational stop signals. The control sequences may be provided with linkers for the purpose of introducing specific restriction sites facilitating ligation of the control sequences with the coding region of the nucleic acid sequence encoding a polypeptide.

[0098] As used herein, the term "operably linked" is defined herein as a configuration in which a control sequence is appropriately placed (i.e., in a functional relationship) at a position relative to a polynucleotide of interest such that the control sequence directs or regulates the expression of the polynucleotide and/or polypeptide of interest.

[0099] As used herein, "promoter sequence" refers to a nucleic acid sequence that is recognized by a host cell for expression of a polynucleotide of interest, such as a coding sequence. The promoter sequence contains transcriptional control sequences, which mediate the expression of a polynucleotide of interest. The promoter may be any nucleic acid sequence that shows transcriptional activity in the host cell of choice including mutant, truncated, and hybrid promoters, and may be obtained from genes encoding extracellular or intracellular polypeptides either homologous or heterologous to the host cell.

[0100] As used herein, the phrase "suitable reaction conditions" refers to those conditions in the enzymatic conversion reaction solution (e.g., ranges of enzyme loading, substrate loading,

temperature, pH, buffers, co-solvents, etc.) under which a amylase polypeptide of the present application is capable of converting a substrate to the desired product compound, Exemplary "suitable reaction conditions" are provided in the present application and illustrated by the Examples.

[0101] As used herein, "loading," such as in "compound loading" or "enzyme loading" refers to the concentration or amount of a component in a reaction mixture at the start of the reaction.

[0102] As used herein, the term "substrate" used in the context of an enzymatic conversion reaction process refers to the compound or molecule acted on by the amylase polypeptide.

[0103] As used herein, the term "product" used in the context of an enzymatic conversion process refers to the compound or molecule resulting from the action of the amylase polypeptide on a substrate.

[0104] As used herein, the term "expression" includes any step involved in the production of the polypeptide including, but not limited to, transcription, post-transcriptional modification, translation, and post-translational modification. In some embodiments, the term also encompasses secretion of the polypeptide from a cell.

[0105] As used herein, the term "produces" refers to the production of proteins and/or other compounds by cells. It is intended that the term encompass any step involved in the production of polypeptides including, but not limited to, transcription, post-transcriptional modification, translation, and post-translational modification. In some embodiments, the term also encompasses secretion of the polypeptide from a cell.

[0106] As used herein, an amino acid or nucleotide sequence (e.g., a promoter sequence, signal peptide, terminator sequence, etc.) is "heterologous" to another sequence with which it is operably linked if the two sequences are not associated in nature.

[0107] As used herein, the terms "host cell" and "host strain" refer to suitable hosts for expression vectors comprising DNA provided herein (e.g., the polynucleotides encoding the amylase variants). In some embodiments, the host cells are prokaryotic or eukaryotic cells that have been transformed or transfected with vectors constructed using recombinant DNA techniques as known in the art.

[0108] The term "analogue" means a polypeptide having more than 70% sequence identity but less than 100% sequence identity (e.g., more than 75%, 78%, 80%, 83%, 85%, 88%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99% sequence identity) with a reference polypeptide. In some embodiments, analogues comprise polypeptides that contain one or more non-naturally occurring amino acid residues including, but not limited, to homoarginine, ornithine and norvaline, as well as naturally occurring amino acids. In some embodiments, analogues also include one or more D-amino acid residues and non-peptide linkages between two or more amino acid residues.

[0109] As used herein, the term "culturing" refers to the growing of a population of cells under any suitable conditions (e.g., using a liquid, gel or solid medium). In some embodiments, the cells are microbial cells (e.g., bacteria), while in some other embodiments, the cells are mammalian cells, insect cells, or cells obtained from another animal. It is not intended that the present invention be limited to culturing of any particular cells or cell types or any specific method of culturing. Indeed, it is intended that the present invention encompass any suitable cell types cultured under any suitable conditions.

[0110] As used herein, the term "therapeutic" refers to a compound that provides beneficial or desirable effects, including medical effects, that is administered to a subject who shows signs or symptoms of pathology.

[0111] As used herein, the term "pharmaceutical composition" refers to a composition suitable for pharmaceutical use in a subject (e.g., human) comprising a pharmaceutically effective amount of an engineered amylase polypeptide encompassed by the invention and an acceptable carrier.

[0112] As used herein, the term "effective amount" means an amount sufficient to produce the desired result. One of general skill in the art may determine what the effective amount by using routine experimentation.

[0113] As used herein, the term "subject" encompasses animals, including but not limited to mammals such as humans, non-human primates, livestock, companion animals, and laboratory animals (e.g., rodents and lagamorphs). It is intended that the term encompass females as well as males.

[0114] As used herein, the term "patient" means any subject that is being assessed for, treated for, or is experiencing disease.

[0115] As used herein, the term "infant" refers to a child in the period of the first month after birth to approximately one (1) year of age. As used herein, the term "newborn" refers to child in the period from birth to the 28th day of life. The term "premature infant" refers to an infant born after the twentieth completed week of gestation, yet before full term, generally weighing ~500 to ~2499 grams at birth. A "very low birth weight infant" is an infant weighing less than 1500 g at birth.

[0116] As used herein, the term "child" refers to a person who has not attained the legal age for consent to treatment or research procedures. In some embodiments, the term refers to a person between the time of birth and adolescence.

[0117] As used herein, the term "adult" refers to a person who has attained legal age for the relevant jurisdiction (e.g., 18 years of age in the United States). In some embodiments, the term refers to any fully grown, mature organism. In some embodiments, the term "young adult" refers to a person less than 18 years of age, but who has reached sexual maturity.

[0118] As used herein, "composition" and "formulation" encompass products comprising at least one engineered amylase of the present invention, intended for any suitable use (e.g., pharmaceutical compositions, dietary and/or nutritional supplements, feed, etc.).

[0119] As used herein, the terms "administration" and "administering" a composition mean providing a composition of the present invention to a subject (e.g., to a person suffering from the effects of pancreatic insufficiency).

[0120] As used herein, the terms "carrier" when used in reference to a pharmaceutical composition means any of the standard pharmaceutical carrier, buffers, and excipients, such as stabilizers, preservatives, and adjuvants.

[0121] As used herein, the term "pharmaceutically acceptable" means a material that can be administered to a subject without causing any undesirable biological effects or interacting in a deleterious manner with any of the components in which it is contained and that possesses the desired biological activity.

[0122] As used herein, the term "excipient" refers to any pharmaceutically acceptable additive, carrier, diluent, adjuvant, or other ingredient, other than the active pharmaceutical ingredient (API; e.g., the engineered amylase polypeptides of the present invention). Excipients are typically included for formulation and/or administration purposes.

[0123] As used herein, the term "therapeutically effective amount" when used in reference to symptoms of disease/condition refers to the amount and/or concentration of a compound (e.g., engineered amylase polypeptides) that ameliorates, attenuates, or eliminates one or more symptom of a disease/condition or prevents or delays the onset of symptom(s).

[0124] As used herein, the term "therapeutically effective amount" when used in reference to a disease/condition refers to the amount and/or concentration of a composition (e.g., engineered amylase polypeptides) that ameliorates, attenuates, or eliminates the disease/condition. In some embodiments, the term is use in reference to the amount of a composition that elicits the biological (e.g., medical) response by a tissue, system, or animal subject that is sought by the researcher, physician, veterinarian, or other clinician.

[0125] As used herein, the terms "treating," "treat," and "treatment" refer to medical care given to a subject (e.g., a human patient), including administration of pharmaceutical compositions, such as those provided herein. It is intended that the terms "treating," "treat" and "treatment" encompass preventative (e.g., prophylactic), as well as palliative treatment or care. In some embodiments, treatment is provided to prevent or ameliorate the symptoms of disease. In some embodiments, the pharmaceutical compositions of the present invention find use in the treatment or prevention of pancreatic enzyme insufficiency disease or conditions.

Engineered Amylase Polypeptides

[0126] The present invention provides engineered amylases suitable for various uses, including treatment of pancreatic enzyme insufficiency. In some embodiments the engineered amylase exhibits at least one improved property compared to wild-type amylase (e.g., the polypeptide of SEQ ID NO: 2). In some embodiments, the engineered amylase has at least about 75%, at least about 75%, at least about 80%, at least about 85%, at least about 88%, at least about 90%, at least about 91%, at least about 92%, at least about 93%, at least about 94%, at least about 95%, at least about 96%, at least about 97%, at least about 98%, at least about 99%, or at about 100% amino acid sequence identity with SEQ ID NO: 2, 18, 40, 156, 174, 276, 308, 422, 456, 546, 632, 664, 780, 988, 1104, 1122, 1224, 1256, 1370, 1404, 1494, 1580, 1612, and/or 1728, and an amino acid residue difference as compared to SEQ ID NO: 2, 18, 40, 156, 174, 276, 308, 422, 456, 546, 632, 664, 780, 988, 1104, 1122, 1224, 1256, 1370, 1404, 1494, 1580, 1612, and/or 1728, at one or more amino acid positions (such as at 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, or more amino acid positions compared to SEQ ID NO: 2, 18, 40, 156, 174, 276, 308, 422, 456, 546, 632, 664, 780, 988, 1104, 1122, 1224, 1256, 1370, 1404, 1494, 1580, 1612, and/or 1728, or a sequence having at least 70%, 75%, 80%, 85%, at least 88%, at least 90%, at least 91%, at least 92%, at least 93%, at least 94%, at least 95%, at least 96%, at least 97%, at least 98%, at least 99% or greater amino acid sequence identity with SEQ ID NO: 2, 18, 40, 156, 174, 276, 308, 422, 456, 546, 632, 664, 780, 988, 1104, 1122, 1224, 1256, 1370, 1404, 1494, 1580, 1612, and/or 1728. In some embodiment the residue difference as compared to SEQ ID NO: 2, 18, 40, 156, 174, 276, 308, 422, 456, 546, 632, 664, 780, 988, 1104, 1122, 1224, 1256, 1370, 1404, 1494, 1580, 1612, and/or 1728, at one or more positions include at least 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, or more conservative amino acid substitutions. In some embodiments, the engineered amylase polypeptide comprises a polypeptide listed in Table 4-1, 4-2, 4-3, 4-4, 4-5, 4-6, 4-7, 4-8, 4-9, 4-10, 4-11, 4-12, 4-13, and/or 4-14; or a polypeptide listed in Table 4-1, 4-2, 4-3, 4-4, 4-5, 4-6, 4-7, 4-8, 4-9, 4-10, 4-11, 4-12, 4-13, wherein the polypeptide is absent the histidine tag and preceding amino acid linker. In some embodiments, the engineered amylase polypeptide comprises SEQ ID NO: 18, 40, 156, 174, 276, 308, 422, 456, 546, 632, 664, 780, 988, 1104, 1122, 1224, 1256, 1370, 1404, 1494, 1580, 1612, or 1728.

[0127] The present invention provide recombinant amylases and/or biologically active recombinant amylase fragments comprising amino acid sequences comprising at least about 70%, at least about 75%, at least about 80%, at least about 85%, at least about 90%, at least about 91%, at least about 92%, at least about 93%, at least about 94%, at least about 95%, at least about 96%, at least about 97%, at least about 98%, or at least about 99% sequence identity to SEQ ID NO: 2. In some embodiments, the recombinant amylase and/or biologically active recombinant amylase fragment comprises a polypeptide sequence having at least about 70%, about 75%, about 76%, about 77%,

about 78%, about 79%, about 80%, about 81%, about 82%, about 83%, about 84%, about 85%, about 86%, about 87%, about 88%, about 89%, about 90%, about 91%, about 92%, about 93%, about 94%, about 95%, about 96%, about 97%, about 98%, about 99%, or more sequence identity to SEQ ID NO: 2, 18, 40, 156, 174, 276, 308, 422, 456, 546, 632, 664, 780, 988, 1104, 1122, 1224, 1256, 1370, 1404, 1494, 1580, 1612, or 1728.

[0128] The present invention provide recombinant amylases and/or biologically active recombinant amylase fragments comprising amino acid sequences comprising at least 70%, at least 75%, at least 80%, at least 85%, at least 90%, at least 91%, at least 92%, at least 93%, at least 94%, at least 95%, at least 96%, at least 97%, at least 98%, or at least 99% sequence identity to SEQ ID NO: 2. In some embodiments, the recombinant amylase comprises a polypeptide sequence having at least 70%, 75%, 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99%, or more sequence identity to SEQ ID NO: 2, or a functional fragment thereof, and comprises one or more substitutions relative to the sequence of SEQ ID NO:2.

[0129] In some embodiments, the recombinant amylase comprises a polypeptide sequence having at least 70%, 75%, 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99%, or more sequence identity to SEQ ID NO: 2, or a functional fragment thereof, and wherein the recombinant amylase comprises one or more substitutions at positions selected from 2, 6, 16, 18, 19, 24, 26, 27, 29, 31, 33, 37, 38, 39, 41, 45, 48, 49, 51, 52, 58, 61, 66, 72, 73, 74, 81, 82, 91, 92, 94, 95, 98, 103, 111, 112, 114, 122, 123, 124, 126, 127, 128, 129, 130, 131, 132, 134, 137, 140, 141, 145, 149, 157, 158, 165, 166, 167, 170, 171, 172, 178, 180, 183, 184, 189, 194, 203, 204, 205, 206, 210, 214, 216, 220, 221, 223, 224, 225, 226, 227, 228, 246, 250, 252, 253, 254, 255, 256, 257, 258, 259, 268, 269, 270, 272, 275, 276, 279, 280, 282, 284, 285, 286, 294, 295, 298, 301, 302, 304, 305, 306, 308, 309, 310, 313, 315, 317, 319, 322, 324, 331, 338S, 345, 346, 349, 359, 360, 366, 371, 374, 380, 383, 384, 385, 387, 388, 392, 393, 394, 396, 397, 409, 411, 412, 413, 415, 417, 420, 423, 428, 429, 431, 437L 441, 442, 444, 446, 448, 451, 455, 458, 459, 463, 464, 466, 467, 468, 469, 470, 473, 474, 480, 481, 482, 483, 491, 492, 493, 494, and 495, wherein the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 2 or 18.

[0130] In some embodiments, the one or more substitutions are at positions selected from 16; 26; 29; 33; 49; 58, 91; 114; 122; 126; 128; 130; 141; 145; 157; 158; 180; 183; 184; 205; 206; 210; 214; 223; 246; 256; 270; 272; 286; 298; 302; 306; 322; 371; 380; 383; 394; 412; 413; 428; and 437. In some embodiments, the one or more substitutions are at positions selected from 16, 26, 29, 33, 49, 91, 58, 114, 122, 128, 130, 141, 145, 157, 158, 183, 246, 256, 270, 272, 286, 298, 302, 322, 371, 380, 383, 394, 412, and 413. In some embodiments, the one or more substitutions are at positions selected from 16, 26, 29, 33, 91, 114, 122, 128, 130, 145, 157, 158, 183, 256, 270, 272, 302, 322, 371, 383, and 394, 412. In some embodiments, the one or more substitutions are at positions selected from 16, 33, 157, 256, 302, 371, and 383.

[0131] In some embodiments, the one or more substitutions are selected from 2K or L; 6I; 16D; 18S; 19E; 24V; 26A; 27L; 29G, R, S, A, or E; 31L; 33E; 37T or R; 38I; 39I; 41F; 45S; 48D; 49A; 51R; 52R; 58T or A; 61Y; 66L; 72T; 73V; 74A; 81E; 82A; 91H; 92A, E, G, or Q; 94G; 95L or V; 98I; 103D or L; 111A; 112Q; 114H or R; 122P, or R; 123E, C, G, or R; 124N or R; 126C, D, E, K, L, M, N, Q, W, R, or S; 127E, I, R, S, V, or W; 128W; 129C or W; 130D; 131H; R, or Y; 132V; 134A, F, or R; 137A; 140K or V; 141F; 145G; 149K, R, or T; 157Y; 158R; 165V; 166L; 167W or Y; 170S; 171I; 172K or R; 178I; 180E, P, or Q; 183E, N, or V; 184D or K; 189D; 194F, E, or R; 203S; 204D; 205V; 206E; 210G or P; 214G, L, or R; 216L; 220G; 221T or V; 223L; 224L; 225G, D, or T; 226T; 227C or V; 228V; 246R or T; 250D; 252I; 253R; 254G or S; 255M or R; 256S; 257E, G, R, S, or V; 258Q or S; 259C, D, Q, R, or W; 268T; 269F; 270D; 272G, K, P, R, or S; 275I or R; 276Q, A, or K; 279L, R, or V; 280C or L; 282R or T; 284C, L, M, R, S, or Y; 285V; 286T; 294H, A, or L; 295N; 298H, K, M, Q, D, or N; 301K; 302Q, G, H, R, V, or W; 304T; 305Q, R, or W; 306F; 308L; 309A or S; 310R; 313D; 315S; 317G; 319L or S; 322R or A; 324T; 331P; 338S; 345A; 346G; 349R; 359G; 360G; 366L; 371F; 374S; 380R; 383E, or L; 384M; 385L; 387G or V; 388E; 392C; 393R, S, or W; 394E, G, N, R, or S; 396H, E, or Q; 397M or T; 409A, R, S, or W; 411E; 412A, L, D, or S; 413Y; 415C or G; 417W; 420V; 423V; 428E or T; 429S; 431T; 437L; 441R or W; 442E, R, or W; 444G, R, or V; 446G; 448P, Q or T; 451F; 455L, R, T, or W; 458F; 459W; 463M; 464L; 466C or E; 467P or W; 468I, T, or V; 469I; 470S, G, L, S, or T; 473D or M; 474G; 480P, T, or L; 481V; 482L; 483A, Q, or T; 491L; 492G or R; 493D; 494C; and 495E, G, L, or Y. In some embodiments, the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 2 or 18. In some further embodiments, the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 40, 156, 174, 276, 308, 422, 456, 546, 632, 664, 780, 988, 1104, 1122, 1224, 1256, 1370, 1404, 1494, 1580, 1612, or 1728, a further described herein.

[0132] In some embodiments, the recombinant amylase and/or biologically active recombinant amylase fragment comprises a polypeptide sequence having at least 70%, 75%, 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99%, or more sequence identity to SEQ ID NO: 18, 40, 156, 174, 276, 308, 422, 456, 546, 632, 664, 780, 988, 1104, 1122, 1224, 1256, 1370, 1404, 1494, 1580, 1612, or 1728. In some embodiments, the recombinant amylase and/or biologically active recombinant amylase fragment comprises a polypeptide sequence having at least 70%, 75%, 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99%, or more sequence identity to SEQ ID NO: 18, 40, 156, 174, 276, 308, 422, 456, 546, 632, 664, 780, 988, 1104, 1122, 1224, 1256, 1370, 1404, 1494, 1580, 1612, or 1728, with the proviso that recombinant amylase does not have the polypeptide sequence of SEQ ID NO:2.

[0133] In some embodiments, the recombinant amylase and/or biologically active recombinant amylase fragment comprises a polypeptide sequence having at least 70%, 75%, 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99%, or more sequence identity

to SEQ ID NO: 18, 40, 156, 174, 276, 308, 422, 456, 546, 632, 664, 780, 988, 1104, 1122, 1224, 1256, 1370, 1404, 1494, 1580, 1612, or 1728, and further comprises one or more substitutions. In some embodiments, the recombinant amylase and/or biologically active recombinant amylase fragment comprises a polypeptide sequence having at least 70%, 75%, 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99%, or more sequence identity to SEQ ID NO: 18, 40, 156, 174, 276, 308, 422, 456, 546, 632, 664, 780, 988, 1104, 1122, 1224, 1256, 1370, 1404, 1494, 1580, 1612, or 1728, and further comprises one or more substitutions at positions selected from 2, 6, 16, 18, 19, 24, 26, 27, 29, 31, 33, 37, 38, 39, 41, 45, 48, 49, 51, 52, 58, 61, 66, 72, 73, 74, 81, 82, 91, 92, 94, 95, 98, 103, 111, 112, 114, 122, 123, 124, 126, 127, 128, 129, 130, 131, 132, 134, 137, 140, 141, 145, 149, 157, 158, 165, 166, 167, 170, 171, 172, 178, 180, 183, 184, 189, 194, 203, 204, 205, 206, 210, 214, 216, 220, 221, 223, 224, 225, 226, 227, 228, 246, 250, 252, 253, 254, 255, 256, 257, 258, 259, 268, 269, 270, 272, 275, 276, 279, 280, 282, 284, 285, 286, 294, 295, 298, 301, 302, 304, 305, 306, 308, 309, 310, 313, 315, 317, 319, 322, 324, 331, 338S, 345, 346, 349, 359, 360, 366, 371, 374, 380, 383, 384, 385, 387, 388, 392, 393, 394, 396, 397, 409, 411, 412, 413, 415, 417, 420, 423, 428, 429, 431, 437L 441, 442, 444, 446, 448, 451, 455, 458, 459, 463, 464, 466, 467, 468, 469, 470, 473, 474, 480, 481, 482, 483, 491, 492, 493, 494, and 495, wherein the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 18, 40, 156, 174, 276, 308, 422, 456, 546, 632, 664, 780, 988, 1104, 1122, 1224, 1256, 1370, 1404, 1494, 1580, 1612, or 1728. In some embodiments, the amino acid substitutions described above for the positions can be used.

[0134] In some additional embodiments, the recombinant amylase comprises a polypeptide sequence having at least 70%, 75%, 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99%, or more sequence identity to SEQ ID NO: 2 or 18, or a functional fragment thereof, and wherein the recombinant amylase comprises one or more substitutions at positions selected from 16, 26, 29, 33, 91, 114,157, 158, 180, 184, 214, 223, 256, 272, 298, 302, 371, 380, 383, 394 412, 428, and 437, wherein the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 2 or 18.

[0135] In some additional embodiments, the recombinant amylase comprises a polypeptide sequence having at least 70%, 75%, 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99%, or more sequence identity to SEQ ID NO: 2 or 18, or a functional fragment thereof, and wherein the recombinant amylase comprises one or more substitutions selected from 16D, 26A, 29G, 29R, 29S, 29A, 29E, 33E, 91H, 114H, 157Y, 158R, 180E, 180Q, 184D, 184K, 214G, 223L, 256T, 272G, 272K, 272P, 272R, 272S, 298H, 302Q, 302G, 302H, 302R, 302V, 302W, 371F, 380R, 383E, 383I, 394N, 394S, 394G, 412A, 412L, 412D, 412S, 428T, and 437L, wherein the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 2 or 18.

[0136] In some additional embodiments, the recombinant amylase comprises a polypeptide sequence having at least 70%, 75%, 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%,

97%, 98%, 99%, or more sequence identity to SEQ ID NO: 2 or 18, or a functional fragment thereof, and wherein the recombinant amylase comprises at least one substitution or substitution set at one or more positions selected from 2/73/256/493, 16/33/73/130/256/282/371/374/493, 16/33/130/256/302/371/383/470, 16/33/157/256/302/371/383, 16/73/74/256/282/366/371/383/493, 16/73/256/282/302/331/371/383, 16/130/256/276/374/470, 16/256/302/374, 19/72/345/473, 26/27/396/412/428/473, 26/27/412, 26/27/466/473, 29, 73/130/256/282/302/493, 74/371/374/383/493, 130/256/493, 149, 158, 254, 256, 256/383, 257, 259, 272, 279, 284, 317/383, 322, 345/388/396/428, 388/396/412/428, 396/412, 396/412/428/466, 409, 412, and 495, wherein the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 2 or 18. In some further embodiments, the recombinant amylase comprises a polypeptide sequence having at least 70%, 75%, 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99%, or more sequence identity to SEQ ID NO: 2 or 18, or a functional fragment thereof, and wherein the recombinant amylase comprises at least one substitution or substitution set selected from 2K/73V/256S/493D, 16D/33E/73V/130D/256S/282D/371F/374S/493D, 16D/33E/130D/256S/302Q/371F/383E/470T, 16D/33E/157Y/256S/302Q/371F/383E, 16D/73V/74A/256S/282D/366L/371F/383E/493D, 16D/73V/256S/282D/302Q/331P/371F/383E, 16D/130D/256S/276Q/374S/470T, 16D/256S/302Q/374S, 19E/72T/345A/473D, 26A/27L/396H/412D/428E/473D, 26A/27L/412D, 26A/27L/466E/473D, 29G, 29R, 29S, 73V/130D/256S/282D/302Q/493D, 74A/371F/374S/383E/493D, 130D/256S/493D, 149R, 149T, 158R, 254G, 254S, 256S, 256S/383E, 257E, 257G, 257R, 257S, 257V, 259Q, 272G, 272K, 272P, 272R, 272S, 279R, 284C, 284R, 284S, 284Y, 317G/383L, 322A, 345A/388E/396H/428E, 388E/396H/412D/428E, 396H/412D, 396H/412D/428E/466E, 409S, 412S, 495E, 495L, and 495Y, wherein the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 2 or 18. In some further embodiments, the recombinant amylase comprises a polypeptide sequence having at least 70%, 75%, 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99%, or more sequence identity to SEQ ID NO: 2 or 18, or a functional fragment thereof, and wherein the recombinant amylase comprises at least one substitution or substitution set selected from R2K/I73V/A256S/E493D, E16D/D33E/I73V/E130D/A256S/E282D/Y371F/H374S/E493D, E16D/D33E/E130D/A256S/M302Q/Y371F/Q383E/V470T, E16D/D33E/F157Y/A256S/M302Q/Y371F/Q383E, E16D/I73V/P74A/A256S/E282D/F366L/Y371F/Q383E/E493D, E16D/I73V/A256S/E282D/M302Q/H331P/Y371F/Q383E, E16D/E130D/A256S/T276Q/H374S/V470T, E16D/A256S/M302Q/H374S, K19E/S72T/P345A/E473D, E26A/R27L/D396H/L412D/D428E/E473D, E26A/R27L/L412D, E26A/R27L/Q466E/E473D, D29G, D29R, D29S, I73V/E130D/A256S/E282D/M302Q/E493D, P74A/Y371F/H374S/Q383E/E493D, E130D/A256S/E493D, Q149R, Q149T, K158R, E254G, E254S,

A256S, A256S/Q383E, P257E, P257G, P257R, P257S, P257V, P259Q, D272G, D272K, D272P, D272R, D272S, D279R, K284C, K284R, K284S, K284Y, V317G/Q383L, F322A, P345A/D388E/D396H/D428E, D388E/D396H/L412D/D428E, D396H/L412D, D396H/L412D/D428E/Q466E, V409S, L412S, I495E, I495L, and I495Y, wherein the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 2 or 18.

[0137] In some additional embodiments, the recombinant amylase comprises a polypeptide sequence having at least 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99%, or more sequence identity to SEQ ID NO: 40 or 988, or a functional fragment thereof, and wherein the recombinant amylase comprises at least one substitution or substitution set at one or more positions selected from 26/29/158/272/412, 26/29/272/279/412/493, 26/29/272/396/412, 26/29/279/412/428, 26/158/272/279/388/412/428, 26/158/272/412, 26/272/279/412/428/493, 29/272/279/396/412, 130/149/254/284/322/409/495, 130/149/257/284/322/409/466/473, 130/254/284/322/374/409/466, 130/257/284/374/409/466, 130/284/322/374/409/473, 149/257/284/322/409/466, 158/272/279/394/396/412/428/493, 158/272/388/412/428/493, 158/272/412/428, 158/279/388/396/412/428, 254/257/284/322/409/473, 254/284/409/466/495, 272/279/412/428/493, 272/412/428, 272/412/493, and 284/322/409/473, wherein the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 40 or 988. In some further embodiments, the recombinant amylase comprises a polypeptide sequence having at least 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99%, or more sequence identity to SEQ ID NO: 40 or 988, or a functional fragment thereof, and wherein the recombinant amylase comprises at least one substitution or substitution set selected from 26A/29R/158R/272G/412D, 26A/29R/272G/279R/412D/493D, 26A/29R/272G/396H/412D, 26A/29R/279R/412D/428E, 26A/158R/272G/279R/388E/412D/428E, 26A/158R/272G/412D, 26A/272G/279R/412D/428E/493D, 29R/272G/279R/396H/412D, 130D/149R/254S/284S/322A/409S/495E, 130D/149R/257G/284S/322A/409S/466E/473D, 130D/254S/284S/322A/374S/409S/466E, 130D/257G/284S/374S/409S/466E, 130D/284S/322A/374S/409S/473D, 149R/257G/284S/322A/409S/466E, 158R/272G/279R/394R/396H/412D/428E/493D, 158R/272G/388E/412D/428E/493D, 158R/272G/412D/428E, 158R/279R/388E/396H/412D/428E, 254S/257G/284S/322A/409S/473D, 254S/284S/409S/466E/495E, 272G/279R/412D/428E/493D, 272G/412D/428E, 272G/412D/493D, and 284S/322A/409S/473D, wherein the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 40 or 988. In some further embodiments, the recombinant amylase comprises a polypeptide sequence having at least 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99%, or more sequence identity to SEQ ID NO: 40 or 988, or a functional fragment thereof, and wherein the recombinant amylase comprises at least one substitution or substitution set selected from E26A/D29R/K158R/D272G/L412D,

E26A/D29R/D272G/D279R/L412D/E493D, E26A/D29R/D272G/D396H/L412D, E26A/D29R/D279R/L412D/D428E, E26A/K158R/D272G/D279R/D388E/L412D/D428E, E26A/K158R/D272G/L412D, E26A/D272G/D279R/L412D/D428E/E493D, D29R/D272G/D279R/D396H/L412D, E130D/Q149R/E254S/K284S/F322A/V409S/I495E, E130D/Q149R/P257G/K284S/F322A/V409S/Q466E/E473D, E130D/E254S/K284S/F322A/H374S/V409S/Q466E, E130D/P257G/K284S/H374S/V409S/Q466E, E130D/K284S/F322A/H374S/V409S/E473D, Q149R/P257G/K284S/F322A/V409S/Q466E, K158R/D272G/D279R/Q394R/D396H/L412D/D428E/E493D, K158R/D272G/D388E/L412D/D428E/E493D, K158R/D272G/L412D/D428E, K158R/D279R/D388E/D396H/L412D/D428E, E254S/P257G/K284S/F322A/V409S/E473D, E254S/K284S/V409S/Q466E/I495E, D272G/D279R/L412D/D428E/E493D, D272G/L412D/D428E, D272G/L412D/E493D, and K284S/F322A/V409S/E473D, wherein the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 40 or 988.

[0138] In some additional embodiments, the recombinant amylase comprises a polypeptide sequence having at least 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99%, or more sequence identity to SEQ ID NO: 156 or 1104, or a functional fragment thereof, and wherein the recombinant amylase comprises at least one substitution or substitution set at one or more positions selected from 37, 51, 91, 111, 112, 114, 122, 124, 128, 140, 167, 171, 183, 194, 276, 280, 298, 397, and 464, wherein the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 156 or 1104. In some further embodiments, the recombinant amylase comprises a polypeptide sequence having at least 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99%, or more sequence identity to SEQ ID NO: 156 or 1104, or a functional fragment thereof, and wherein the recombinant amylase comprises at least one substitution or substitution set selected from 37R, 51R, 91H, 111A, 112Q, 114H, 122P, 122R, 124R, 128W, 140K, 167W, 171I, 183E, 183N, 183V, 194E, 194R, 276A, 276K, 280L, 298K, 298M, 397T, and 464L, wherein the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 156 or 1104. In some further embodiments, the recombinant amylase comprises a polypeptide sequence having at least 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99%, or more sequence identity to SEQ ID NO: 156 or 1104, or a functional fragment thereof, and wherein the recombinant amylase comprises at least one substitution or substitution set selected from N37R, G51R, K91H, E111A, K112Q, A114H, A122P, A122R, D124R, I128W, R140K, E167W, E171I, G183E, G183N, G183V, L194E, L194R, T276A, T276K, Q280L, E298K, E298M, E397T, and N464L, wherein the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 156 or 1104.

[0139] In some additional embodiments, the recombinant amylase comprises a polypeptide sequence having at least 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%,

99%, or more sequence identity to SEQ ID NO: 174 or 1122, or a functional fragment thereof, and wherein the recombinant amylase comprises at least one substitution or substitution set at one or more positions selected from 24, 91, 91/122, 91/122/128/130/167/171/409, 91/122/128/130/183/322, 91/122/128/130/194, 91/122/128/130/322, 91/122/128/171/183/194/322, 91/122/128/183/409, 91/122/130/167/183/194/409, 91/122/130/171/183, 91/122/130/183/194, 91/122/130/194, 91/122/130/194/322, 91/122/167/171/194, 91/122/167/171/194/322, 91/122/171/183/194/409, 91/130/171/183/322/409, 91/167/171, 91/167/183/194, 91/167/322, 91/183, 91/183/322/409, 91/194, 91/322, 91/409, 122/128, 122/128/194/409, 122/130/171/322/409, 122/409, 137/145/227/394/480/481, 137/145/295, 145/227/295/481, 145/309/481, 183, 227, 295/394, 322, 322/409, 394, and 480/481, wherein the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 174 or 1122. In some further embodiments, the recombinant amylase comprises a polypeptide sequence having at least 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99%, or more sequence identity to SEQ ID NO: 174 or 1122, or a functional fragment thereof, and wherein the recombinant amylase comprises at least one substitution or substitution set selected from 24V, 91H, 91H/122P, 91H/122P/130D/183N/194R, 91H/122P/130D/194R/322A, 91H/122R, 91H/122R/128W/130D/167W/171I/409S, 91H/122R/128W/130D/183N/322A, 91H/122R/128W/130D/194R, 91H/122R/128W/130D/322A, 91H/122R/128W/171I/183N/194R/322A, 91H/122R/128W/183N/409S, 91H/122R/130D/167W/183N/194R/409S, 91H/122R/130D/171I/183N, 91H/122R/130D/194R, 91H/122R/167W/171I/194R, 91H/122R/167W/171I/194R/322A, 91H/122R/171I/183N/194R/409S, 91H/130D/171I/183N/322A/409S, 91H/167W/171I, 91H/167W/183N/194R, 91H/167W/322A, 91H/183N, 91H/183N/322A/409S, 91H/194R, 91H/322A, 91H/409S, 122P/409S, 122R/128W, 122R/128W/194R/409S, 122R/130D/171I/322A/409S, 137A/145G/227L/394E/480P/481V, 137A/145G/295N, 145G/227L/295N/481V, 145G/309S/481V, 183N, 227L, 295N/394E, 322A, 322A/409S, 394E, and 480T/481V, wherein the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 174 or 1122. In some further embodiments, the recombinant amylase comprises a polypeptide sequence having at least 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99%, or more sequence identity to SEQ ID NO: 174 or 1122, or a functional fragment thereof, and wherein the recombinant amylase comprises at least one substitution or substitution set selected from L24V, K91H, K91H/A122P, K91H/A122P/E130D/G183N/L194R, K91H/A122P/E130D/L194R/F322A, K91H/A122R, K91H/A122R/I128W/E130D/E167W/E171I/V409S, K91H/A122R/I128W/E130D/G183N/F322A, K91H/A122R/I128W/E130D/L194R, K91H/A122R/I128W/E130D/F322A, K91H/A122R/I128W/E171I/G183N/L194R/F322A, K91H/A122R/I128W/G183N/V409S, K91H/A122R/E130D/E167W/G183N/L194R/V409S, K91H/A122R/E130D/E171I/G183N, K91H/A122R/E130D/L194R, K91H/A122R/E167W/E171I/L194R,

K91H/A122R/E167W/E171I/L194R/F322A, K91H/A122R/E171I/G183N/L194R/V409S, K91H/E130D/E171I/G183N/F322A/V409S, K91H/E167W/E171I, K91H/E167W/G183N/L194R, K91H/E167W/F322A, K91H/G183N, K91H/G183N/F322A/V409S, K91H/L194R, K91H/F322A, K91H/V409S, A122P/V409S, A122R/I128W, A122R/I128W/L194R/V409S, A122R/E130D/E171I/F322A/V409S, G137A/A145G/T227L/Q394E/F480P/C481V, G137A/A145G/K295N, A145G/T227L/K295N/C481V, A145G/T309S/C481V, G183N, T227L, K295N/Q394E, F322A, F322A/V409S, Q394E, and F480T/C481V, wherein the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 174 or 1122.

[0140] In some additional embodiments, the recombinant amylase comprises a polypeptide sequence having at least 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99%, or more sequence identity to SEQ ID NO: 276 or 1224, or a functional fragment thereof, and wherein the recombinant amylase comprises at least one substitution or substitution set at one or more positions selected from 16/26/29/128/145/256/309/383, 16/26/33/114/145/309/383/394, 16/26/33/128/130/145/302/309/322/371, 16/26/33/145/158/383/394, 16/26/145/302, 16/29/33/145/256/302, 18, 26/29/33/130/145/157/158/183/394, 26/29/33/145/157/183/256/309/383, 26/29/122/130/145/183/256/272/309/394, 26/29/145/157/256/302/322/481, 26/29/145/256/272/302/309/322/481, 26/33/91/145/272/302/481, 26/33/145/309/322/383, 26/114/145/322, 26/145/183/256/309/383, 29/122/145/158/383, 29/130/145/256/272/371/394, 29/145/183/302/309/412, 29/309/394, 33/122/145/272/309/412, 91/130/145/158/183/383, 91/309/383, 130/145/256/272/371, 130/145/302/309, 130/272/481, 145/302/309, 268, 309, 349, 360, 380, 394, 463, and 483, wherein the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 276 or 1224. In some further embodiments, the recombinant amylase comprises a polypeptide sequence having at least 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99%, or more sequence identity to SEQ ID NO: 276 or 1224, or a functional fragment thereof, and wherein the recombinant amylase comprises at least one substitution or substitution set selected from 16E/26E/29D/128I/145G/256A/309S/383Q, 16E/26E/33D/114A/145G/309S/383Q/394E, 16E/26E/33D/128I/130E/145G/302M/309S/322F/371Y, 16E/26E/33D/145G/158K/383Q/394E, 16E/26E/145G/302M, 16E/29D/33D/145G/256A/302M, 18S, 26E/29D/33D/130E/145G/157F/158K/183G/394E, 26E/29D/33D/145G/157F/183G/256A/309S/383Q, 26E/29D/122A/130E/145G/183G/256A/272D/309S/394E, 26E/29D/145G/157F/256A/302M/322F/481V, 26E/29D/145G/256A/272D/302M/309S/322F/481V, 26E/33D/91K/145G/272D/302M/481V, 26E/33D/145G/309S/322F/383Q, 26E/114A/145G/322F, 26E/145G/183G/256A/309S/383Q, 29D/122A/145G/158K/383Q, 29D/130E/145G/256A/272D/371Y/394E, 29D/145G/183G/302M/309S/412L, 29D/309S/394E, 33D/122A/145G/272D/309S/412L, 91K/130E/145G/158K/183G/383Q, 91K/309S/383Q,

130E/145G/256A/272D/371Y, 130E/145G/302M/309S, 130E/272D/481V, 145G/302M/309S, 268T, 309A, 349R, 360G, 380R, 394G, 394N, 394S, 463M, and 483T, wherein the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 276 or 1224. In some further embodiments, the recombinant amylase comprises a polypeptide sequence having at least 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99%, or more sequence identity to SEQ ID NO: 276 or 1224, or a functional fragment thereof, and wherein the recombinant amylase comprises at least one substitution or substitution set selected from D16E/A26E/R29D/W128I/A145G/S256A/T309S/E383Q, D16E/A26E/E33D/H114A/A145G/T309S/E383Q/Q394E, D16E/A26E/E33D/W128I/D130E/A145G/Q302M/T309S/A322F/F371Y, D16E/A26E/E33D/A145G/R158K/E383Q/Q394E, D16E/A26E/A145G/Q302M, D16E/R29D/E33D/A145G/S256A/Q302M, G18S, A26E/R29D/E33D/D130E/A145G/Y157F/R158K/N183G/Q394E, A26E/R29D/E33D/A145G/Y157F/N183G/S256A/T309S/E383Q, A26E/R29D/R122A/D130E/A145G/N183G/S256A/G272D/T309S/Q394E, A26E/R29D/A145G/Y157F/S256A/Q302M/A322F/C481V, A26E/R29D/A145G/S256A/G272D/Q302M/T309S/A322F/C481V, A26E/E33D/H91K/A145G/G272D/Q302M/C481V, A26E/E33D/A145G/T309S/A322F/E383Q, A26E/H114A/A145G/A322F, A26E/A145G/N183G/S256A/T309S/E383Q, R29D/R122A/A145G/R158K/E383Q, R29D/D130E/A145G/S256A/G272D/F371Y/Q394E, R29D/A145G/N183G/Q302M/T309S/D412L, R29D/T309S/Q394E, E33D/R122A/A145G/G272D/T309S/D412L, H91K/D130E/A145G/R158K/N183G/E383Q, H91K/T309S/E383Q, D130E/A145G/S256A/G272D/F371Y, D130E/A145G/Q302M/T309S, D130E/G272D/C481V, A145G/Q302M/T309S, S268T, T309A, P349R, N360G, G380R, Q394G, Q394N, Q394S, G463M, and G483T, wherein the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 276 or 1224.

[0141] In some additional embodiments, the recombinant amylase comprises a polypeptide sequence having at least 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99%, or more sequence identity to SEQ ID NO: 308 or 1256, or a functional fragment thereof, and wherein the recombinant amylase comprises at least one substitution or substitution set at one or more positions selected from 29, 37/124/250/270/349/380/394/442/491, 37/145, 37/145/250/301/349/394, 37/145/258/442/491, 38/349/491, 81/259, 81/313/495, 92/257/258/338/468, 92/258, 94/127/132/145/250/349, 94/270/301/349/394/442, 94/349/491, 145/270, 178, 225, 226, 246, 250/349/442, 259/313/338, 270/349, 286/338, 294, 313, 349, 349/380/442, 413, 413/468, 448, and 473, wherein the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 308 or 1256. In some further embodiments, the recombinant amylase comprises a

polypeptide sequence having at least 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99%, or more sequence identity to SEQ ID NO: 308 or 1256, or a functional fragment thereof, and wherein the recombinant amylase comprises at least one substitution or substitution set selected from 29A, 37T/124N/250D/270D/349R/380R/394E/442E/491L, 37T/145G, 37T/145G/250D/301K/349R/394E, 37T/145G/258S/442E/491L, 38I/349R/491L, 81E/259D, 81E/313D/495L, 92E/257E/258Q/338S/468T, 92E/258Q, 94G/127E/132V/145G/250D/349R, 94G/270D/301K/349R/394E/442E, 94G/349R/491L, 145G/270D, 178I, 225D, 226T, 246R, 250D/349R/442E, 259D/313D/338S, 270D/349R, 286T/338S, 294L, 313D, 349R, 349R/380R/442E, 413Y, 413Y/468I, 448T, and 473D, wherein the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 308 or 1256. In some further embodiments, the recombinant amylase comprises a polypeptide sequence having at least 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99%, or more sequence identity to SEQ ID NO: 308 or 1256, or a functional fragment thereof, and wherein the recombinant amylase comprises at least one substitution or substitution set selected from R29A, N37T/D124N/E250D/E270D/P349R/G380R/G394E/D442E/I491L, N37T/A145G, N37T/A145G/E250D/R301K/P349R/G394E, N37T/A145G/K258S/D442E/I491L, M38I/P349R/I491L, A81E/P259D, A81E/T313D/I495L, R92E/P257E/K258Q/A338S/R468T, R92E/K258Q, D94G/Q127E/I132V/A145G/E250D/P349R, D94G/E270D/R301K/P349R/G394E/D442E, D94G/P349R/I491L, A145G/E270D, V178I, E225D, Q226T, K246R, E250D/P349R/D442E, P259D/T313D/A338S, E270D/P349R, M286T/A338S, M294L, T313D, P349R, P349R/G380R/D442E, F413Y, F413Y/R468I, H448T, and E473D, wherein the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 308 or 1256.

[0142] In some additional embodiments, the recombinant amylase comprises a polypeptide sequence having at least 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99%, or more sequence identity to SEQ ID NO: 422 or 1370, or a functional fragment thereof, and wherein the recombinant amylase comprises at least one substitution or substitution set at one or more positions selected from 38, 38/178/226/286/338, 38/178/286/448, 38/178/349/448, 38/226/246/258/286, 38/226/258/286/338/380/448, 38/226/258/349/413, 38/226/286, 38/226/286/338/380, 38/226/338/349/380, 38/226/413/448, 38/246/286, 38/246/286/380, 38/258, 38/286, 38/286/413/448, 38/286/448, 38/448, 178, 178/226/258/286/310/338, 178/226/286/338, 178/246/338, 178/258/286/413, 178/286, 178/286/338/349, 178/286/338/448, 178/380, 178/413, 178/448, 184/246/258/380, 226, 226/246/286/349/448, 226/246/413, 226/258/286/349/380, 226/258/286/413/448, 226/286, 226/286/380/448, 226/349/380, 246, 246/286, 246/286/380/413, 246/338, 246/413, 258/286/413, 286, 286/413/448, 338/448, 349, and 413, wherein the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 422 or 1370. In

some further embodiments, the recombinant amylase comprises a polypeptide sequence having at least 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99%, or more sequence identity to SEQ ID NO: 422 or 1370, or a functional fragment thereof, and wherein the recombinant amylase comprises at least one substitution or substitution set selected from 38I, 38I/178I/226T/286T/338S, 38I/178I/286T/448T, 38I/178I/349R/448T, 38I/226T/246R/258S/286T, 38I/226T/258S/286T/338S/380R/448T, 38I/226T/258S/349R/413Y, 38I/226T/286T, 38I/226T/286T/338S/380R, 38I/226T/338S/349R/380R, 38I/226T/413Y/448T, 38I/246R/286T, 38I/246R/286T/380R, 38I/258S, 38I/286T, 38I/286T/413Y/448T, 38I/286T/448T, 38I/448T, 178I, 178I/226T/258S/286T/310R/338S, 178I/226T/286T/338S, 178I/246R/338S, 178I/258S/286T/413Y, 178I/286T, 178I/286T/338S/349R, 178I/286T/338S/448T, 178I/380R, 178I/413Y, 178I/448T, 184K/246R/258S/380R, 226T, 226T/246R/286T/349R/448T, 226T/246R/413Y, 226T/258S/286T/349R/380R, 226T/258S/286T/413Y/448T, 226T/286T, 226T/286T/380R/448T, 226T/349R/380R, 246R, 246R/286T, 246R/286T/380R/413Y, 246R/338S, 246R/413Y, 246T, 258S/286T/413Y, 286T, 286T/413Y/448T, 338S/448T, 349R, and 413Y, wherein the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 422 or 1370. In some further embodiments, the recombinant amylase comprises a polypeptide sequence having at least 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99%, or more sequence identity to SEQ ID NO: 422 or 1370, or a functional fragment thereof, and wherein the recombinant amylase comprises at least one substitution or substitution set selected from M38I, M38I/V178I/Q226T/M286T/A338S, M38I/V178I/M286T/H448T, M38I/V178I/P349R/H448T, M38I/Q226T/K246R/K258S/M286T, M38I/Q226T/K258S/M286T/A338S/G380R/H448T, M38I/Q226T/K258S/P349R/F413Y, M38I/Q226T/M286T, M38I/Q226T/M286T/A338S/G380R, M38I/Q226T/A338S/P349R/G380R, M38I/Q226T/F413Y/H448T, M38I/K246R/M286T, M38I/K246R/M286T/G380R, M38I/K258S, M38I/M286T, M38I/M286T/F413Y/H448T, M38I/M286T/H448T, M38I/H448T, V178I, V178I/Q226T/K258S/M286T/Q310R/A338S, V178I/Q226T/M286T/A338S, V178I/K246R/A338S, V178I/K258S/M286T/F413Y, V178I/M286T, V178I/M286T/A338S/P349R, V178I/M286T/A338S/H448T, V178I/G380R, V178I/F413Y, V178I/H448T, E184K/K246R/K258S/G380R, Q226T, Q226T/K246R/M286T/P349R/H448T, Q226T/K246R/F413Y, Q226T/K258S/M286T/P349R/G380R, Q226T/K258S/M286T/F413Y/H448T, Q226T/M286T, Q226T/M286T/G380R/H448T, Q226T/P349R/G380R, K246R, K246R/M286T, K246R/M286T/G380R/F413Y, K246R/A338S, K246R/F413Y, K246T, K258S/M286T/F413Y, M286T, M286T/F413Y/H448T, A338S/H448T, P349R, and F413Y, wherein the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 422 or 1370.

[0143] In some additional embodiments, the recombinant amylase comprises a polypeptide sequence having at least 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99%, or more sequence identity to SEQ ID NO: 456 or 1404, or a functional fragment thereof, and

wherein the recombinant amylase comprises at least one substitution or substitution set at one or more positions selected from 29/31/92/220, 29/469, 49/58/103/141/197/269/294/298, 49/58/103/194/204/298, 49/58/141/298, 49/103, 103, 123, 126, 127, 131, 134, 180, 210, 214, 220/469, 228, 259, 279, 282, 302, 319, 393, 415, 417, 428, 429, 466, and 469, wherein the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 456 or 1404. In some further embodiments, the recombinant amylase comprises a polypeptide sequence having at least 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99%, or more sequence identity to SEQ ID NO: 456 or 1404, or a functional fragment thereof, and wherein the recombinant amylase comprises at least one substitution or substitution set selected from 29E/31L/92A/220G, 29E/469I, 49A/58T/103L/141F/197Y/269F/294H/298Q, 49A/58T/103L/194F/204D/298H, 49A/58T/141F/298H, 49A/103L, 103L, 123R, 126R, 127W, 131H, 131R, 131Y, 134R, 180E, 210P, 214G, 220G/469I, 228V, 259C, 279L, 282T, 302H, 302R, 302W, 319S, 393R, 393S, 415C, 417W, 428T, 429S, 466C, and 469I, wherein the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 456 or 1404. In some further embodiments, the recombinant amylase comprises a polypeptide sequence having at least 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99%, or more sequence identity to SEQ ID NO: 456 or 1404, or a functional fragment thereof, and wherein the recombinant amylase comprises at least one substitution or substitution set selected from R29E/F31L/R92A/A220G, R29E/V469I, S49A/S58T/V103L/Y141F/F197Y/H269F/M294H/E298Q, S49A/S58T/V103L/L194F/N204D/E298H, S49A/S58T/Y141F/E298H, S49A/V103L, V103L, D123R, T126R, Q127W, E131H, E131R, E131Y, E134R, D180E, H210P, E214G, A220G/V469I, Q228V, P259C, D279L, E282T, Q302H, Q302R, Q302W, A319S, E393R, E393S, D415C, P417W, D428T, E429S, Q466C, and V469I, wherein the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 456 or 1404.

[0144] In some additional embodiments, the recombinant amylase comprises a polypeptide sequence having at least 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99%, or more sequence identity to SEQ ID NO: 456 or 1404, or a functional fragment thereof, and wherein the recombinant amylase comprises at least one substitution or substitution set at one or more positions selected from 92, 123, 126, 127, 129, 131, 134, 140, 172, 180, 210, 214, 221, 228, 253, 254, 259, 279, 282, 302, 304, 305, 319, 322, 346, 359, 384, 385, 387, 393, 409, 412, 415, 417, 428, 429, 441, 442, 444, 446, 451, 455, 459, 466, 467, 470, 473, 474, 492, and 494, wherein the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 456 or 1404. In some further embodiments, the recombinant amylase comprises a polypeptide sequence having at least 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99%, or more sequence identity to SEQ ID NO: 456 or 1404, or a functional fragment thereof, and wherein the recombinant amylase comprises at least one substitution or substitution set selected from 92G, 92Q,

123C, 123G, 123R, 126Q, 126R, 127I, 127R, 127S, 127V, 127W, 129C, 129W, 131H, 131R, 131Y, 134A, 134F, 134R, 140V, 172K, 172R, 180E, 180P, 180Q, 210G, 210P, 214G, 214L, 214R, 221T, 221V, 228V, 253R, 254G, 259C, 259R, 259W, 279L, 279V, 282R, 282T, 302G, 302H, 302R, 302V, 302W, 304T, 305Q, 305R, 305W, 319L, 319S, 322R, 346G, 359G, 384M, 385L, 387G, 387V, 393R, 393S, 393W, 409A, 409R, 409W, 412A, 415C, 415G, 417W, 428T, 429S, 441R, 441W, 442R, 442W, 444G, 444R, 444V, 446G, 451F, 455L, 455R, 455T, 455W, 459W, 466C, 467P, 467W, 470G, 470L, 470S, 473M, 474G, 492G, 492R, and 494C, wherein the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 456 or 1404. In some further embodiments, the recombinant amylase comprises a polypeptide sequence having at least 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99%, or more sequence identity to SEQ ID NO: 456 or 1404, or a functional fragment thereof, and wherein the recombinant amylase comprises at least one substitution or substitution set selected from R92G, R92Q, D123C, D123G, D123R, T126Q, T126R, Q127I, Q127R, Q127S, Q127V, Q127W, D129C, D129W, E131H, E131R, E131Y, E134A, E134F, E134R, R140V, D172K, D172R, D180E, D180P, D180Q, H210G, H210P, E214G, E214L, E214R, R221T, R221V, Q228V, Q253R, E254G, P259C, P259R, P259W, D279L, D279V, E282R, E282T, Q302G, Q302H, Q302R, Q302V, Q302W, R304T, D305Q, D305R, D305W, A319L, A319S, A322R, W346G, E359G, T384M, Y385L, I387G, I387V, E393R, E393S, E393W, V409A, V409R, V409W, D412A, D415C, D415G, P417W, D428T, E429S, D441R, D441W, D442R, D442W, E444G, E444R, E444V, T446G, E451F, N455L, N455R, N455T, N455W, R459W, Q466C, E467P, E467W, V470G, V470L, V470S, E473M, N474G, E492G, E492R, and V494C, wherein the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 456 or 1404.

[0145] In some additional embodiments, the recombinant amylase comprises a polypeptide sequence having at least 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99%, or more sequence identity to SEQ ID NO: 546 or 1494, or a functional fragment thereof, and wherein the recombinant amylase comprises at least one substitution or substitution set at one or more positions selected from 123, 123/126/180/214/298/302/393, 123/126/180/214/393/428, 123/126/210/298/302/393, 123/126/210/428, 123/126/428, 123/210/302, 126/180/210/214/298/302, 126/180/210/214/428, 126/180/298/302/393, 126/210/302/428, 126/214/393, 126/298/302/393, 126/298/302/393/428, 129, 129/228/253, 131/228/279, 131/282, 180/214, 210/214/302/393/428, 228/282/444, 253/279/470, 253/279/492, 279, 279/470, and 441, wherein the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 546 or 1494. In some further embodiments, the recombinant amylase comprises a polypeptide sequence having at least 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99%, or more sequence identity to SEQ ID NO: 546 or 1494, or a functional fragment thereof, and wherein the recombinant amylase comprises at least one substitution or substitution set selected from 123R,

123R/126R/180E/214L/298Q/302W/393R, 123R/126R/180Q/214G/393R/428T, 123R/126R/210P/298Q/302W/393R, 123R/126R/210P/428T, 123R/126R/428T, 123R/210P/302R, 126R/180E/210P/214G/428T, 126R/180E/298Q/302R/393R, 126R/180Q/210P/214L/298Q/302R, 126R/210P/302R/428T, 126R/214G/393R, 126R/298Q/302H/393R, 126R/298Q/302R/393R/428T, 129W, 129W/228V/253R, 131H/228V/279V, 131Y/282T, 180Q/214L, 210P/214L/302R/393R/428T, 228V/282T/444R, 253R/279L/492G, 253R/279V/470S, 279L, 279L/470S, and 441R, wherein the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 546 or 1494. In some further embodiments, the recombinant amylase comprises a polypeptide sequence having at least 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99%, or more sequence identity to SEQ ID NO: 546 or 1494, or a functional fragment thereof, and wherein the recombinant amylase comprises at least one substitution or substitution set selected from D123R, D123R/T126R/D180E/E214L/H298Q/Q302W/E393R, D123R/T126R/D180Q/E214G/E393R/D428T, D123R/T126R/H210P/H298Q/Q302W/E393R, D123R/T126R/H210P/D428T, D123R/T126R/D428T, D123R/H210P/Q302R, T126R/D180E/H210P/E214G/D428T, T126R/D180E/H298Q/Q302R/E393R, T126R/D180Q/H210P/E214L/H298Q/Q302R, T126R/H210P/Q302R/D428T, T126R/E214G/E393R, T126R/H298Q/Q302H/E393R, T126R/H298Q/Q302R/E393R/D428T, D129W, D129W/Q228V/Q253R, E131H/Q228V/D279V, E131Y/E282T, D180Q/E214L, H210P/E214L/Q302R/E393R/D428T, Q228V/E282T/E444R, Q253R/D279L/E492G, Q253R/D279V/V470S, D279L, D279L/V470S, and D441R, wherein the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 546 or 1494.

[0146] In some additional embodiments, the recombinant amylase comprises a polypeptide sequence having at least 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99%, or more sequence identity to SEQ ID NO: 632 or 1580, or a functional fragment thereof, and wherein the recombinant amylase comprises at least one substitution or substitution set at one or more positions selected from 2, 45/166/298, 48, 48/166/170/203, 52, 58/166, 58/203, 72, 82, 114, 114/223/306/308, 149, 165, 166/203, 167, 170, 184/216/306/308, 184/223/306/437, 189, 203, 225, 255, 258, 275, 280, 284, 294, 298, 396, 397, 411, 431, 448, 468, 482, 483, and 495, wherein the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 632 or 1580. In some further embodiments, the recombinant amylase comprises a polypeptide sequence having at least 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99%, or more sequence identity to SEQ ID NO: 632 or 1580, or a functional fragment thereof, and wherein the recombinant amylase comprises at least one substitution or substitution set selected from 2L, 45S/166L/298D, 48D, 48D/166L/170S/203S, 52R, 58A/166L, 58A/203S, 72T, 82A, 114R, 114R/223L/306F/308L, 149K, 165V, 166L/203S, 167Y, 170S, 184D/216L/306F/308L, 184D/223L/306F/437L, 189D, 203S, 225T, 255M, 255R, 258S, 275I, 275R, 280C, 284L, 284M,

294A, 298D, 298N, 396E, 396Q, 397M, 411E, 431T, 448P, 468V, 482L, 483A, 495G, and 495L, wherein the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 632 or 1580. In some further embodiments, the recombinant amylase comprises a polypeptide sequence having at least 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99%, or more sequence identity to SEQ ID NO: 632 or 1580, or a functional fragment thereof, and wherein the recombinant amylase comprises at least one substitution or substitution set selected from R2L, Y45S/I166L/H298D, A48D, A48D/I166L/D170S/E203S, Y52R, T58A/I166L, T58A/E203S, S72T, Q82A, H114R, H114R/V223L/Y306F/M308L, Q149K, H165V, I166L/E203S, E167Y, D170S, E184D/I216L/Y306F/M308L, E184D/V223L/Y306F/M437L, Q189D, E203S, E225T, V255M, V255R, K258S, Q275I, Q275R, Q280C, K284L, K284M, M294A, H298D, H298N, D396E, D396Q, E397M, T411E, P431T, H448P, R468V, N482L, G483A, I495G, and I495L, wherein the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 632 or 1580.

[0147] In some additional embodiments, the recombinant amylase comprises a polypeptide sequence having at least 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99%, or more sequence identity to SEQ ID NO: 664 or 1612, or a functional fragment thereof, and wherein the recombinant amylase comprises at least one substitution or substitution set at one or more positions selected from 6/39/103/324/420, 41, 58/500/501, 61, 95/98/205/227/423/458, 95/98/227/423, 95/205, 95/252/285/324, 123/170/197/275/298/396/448/483, 123/197, 123/197/225/294/396/448/469, 123/284/294/324/396/448, 134/225/275/302, 165/225/284/298/469/483, 170/275/294/298/448, 205/206, 205/206/224/315/458/480, 206/227, 206/227/315/423, 225/294/298/396, 227, 392/503, 458, 499, and 500, wherein the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 664 or 1612. In some further embodiments, the recombinant amylase comprises a polypeptide sequence having at least 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99%, or more sequence identity to SEQ ID NO: 664 or 1612, or a functional fragment thereof, and wherein the recombinant amylase comprises at least one substitution or substitution set selected from 6I/39I/103D/324T/420V, 41F, 58S/500P/501P, 61Y, 95L/252I/285V/324T, 95V/98I/205V/227V/423V/458F, 95V/98I/227V/423V, 95V/205V, 123E/170S/197Y/275I/298N/396Q/448Q/483Q, 123E/197Y, 123E/197Y/225G/294A/396Q/448Q/469I, 123E/284L/294A/324T/396Q/448Q, 134R/225G/275I/302W, 165V/225G/284L/298N/469I/483Q, 170S/275I/294A/298N/448Q, 205V/206E, 205V/206E/224L/315S/458F/480L, 206E/227V, 206E/227V/315S/423V, 225G/294A/298N/396Q, 227C, 392C/503L, 458F, 458Y, 499R, and 500P, wherein the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 664 or 1612. In some further embodiments, the recombinant amylase comprises a polypeptide sequence having at

least 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99%, or more sequence identity to SEQ ID NO: 664 or 1612, or a functional fragment thereof, and wherein the recombinant amylase comprises at least one substitution or substitution set selected from L6I/V39I/V103D/A324T/I420V, L41F, T58S/H500P/H501P, L61Y, I95L/V252I/T285V/A324T, I95V/L98I/I205V/T227V/S423V/W458F, I95V/L98I/T227V/S423V, I95V/I205V, D123E/D170S/F197Y/Q275I/H298N/D396Q/H448Q/G483Q, D123E/F197Y, D123E/F197Y/E225G/M294A/D396Q/H448Q/V469I, D123E/K284L/M294A/A324T/D396Q/H448Q, E134R/E225G/Q275I/Q302W, H165V/E225G/K284L/H298N/V469I/G483Q, D170S/Q275I/M294A/H298N/H448Q, I205V/D206E, I205V/D206E/M224L/T315S/W458F/F480L, D206E/T227V, D206E/T227V/T315S/S423V, E225G/M294A/H298N/D396Q, T227C, I392C/H503L, W458F, W458Y, G499R, and H500P, wherein the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 664 or 1612.

[0148] In some additional embodiments, the recombinant amylase comprises a polypeptide sequence having at least 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99%, or more sequence identity to SEQ ID NO: 664 or 1612, or a functional fragment thereof, and wherein the recombinant amylase comprises at least one substitution or substitution set at one or more positions selected from 95/252/285/324, 123/197, 123/197/225/294/396/448/469, 134/225/275/302, 205/206, and 205/206/224/315/458/480, wherein the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 664 or 1612. In some further embodiments, the recombinant amylase comprises a polypeptide sequence having at least 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99%, or more sequence identity to SEQ ID NO: 664 or 1612, or a functional fragment thereof, and wherein the recombinant amylase comprises at least one substitution or substitution set selected from 95L/252I/285V/324T, 123E/197Y, 123E/197Y/225G/294A/396Q/448Q/469I, 134R/225G/275I/302W, 205V/206E, and 205V/206E/224L/315S/458F/480L, wherein the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 664 or 1612. In some further embodiments, the recombinant amylase comprises a polypeptide sequence having at least 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99%, or more sequence identity to SEQ ID NO: 664 or 1612, or a functional fragment thereof, and wherein the recombinant amylase comprises at least one substitution or substitution set selected from I95L/V252I/T285V/A324T, D123E/F197Y, D123E/F197Y/E225G/M294A/D396Q/H448Q/V469I, E134R/E225G/Q275I/Q302W, I205V/D206E, and I205V/D206E/M224L/T315S/W458F/F480L, wherein the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 664 or 1612.

[0149] In some additional embodiments, the recombinant amylase comprises a polypeptide sequence having at least 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%,

99%, or more sequence identity to SEQ ID NO: 780 or 1728, or a functional fragment thereof, and wherein the recombinant amylase comprises a substitution at position 126, wherein the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 780 or 1728. In some further embodiments, the recombinant amylase comprises a polypeptide sequence having at least 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99%, or more sequence identity to SEQ ID NO: 780 or 1728, or a functional fragment thereof, and wherein the recombinant amylase comprises at least one substitution or substitution set selected from 126C, 126D, 126E, 126K, 126L, 126M, 126N, 126Q, 126S, 126T, and 126W, wherein the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 780 or 1728. In some further embodiments, the recombinant amylase comprises a polypeptide sequence having at least 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99%, or more sequence identity to SEQ ID NO: 780 or 1728, or a functional fragment thereof, and wherein the recombinant amylase comprises at least one substitution or substitution set selected from R126C, R126D, R126E, R126K, R126L, R126M, R126N, R126Q, R126S, R126T, and R126W, wherein the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 780 or 1728.

[0150] In some additional embodiments, the recombinant amylase comprises at least one mutation in at least one position as provided in Table 4-1, 4-2, 4-3, 4-4, 4-5, 4-6, 4-7, 4-8, 4-9, 4-10, 4-11, 4-12, 4-13, and/or 4-14, wherein the positions are numbered with reference to SEQ ID NO: 2, 18, 40, 156, 174, 276, 308, 422, 456, 546, 632, 664, 780, 988, 1104, 1122, 1224, 1256, 1370, 1404, 1494, 1580, 1612, and/or 1728. In some further embodiments, the recombinant amylase comprises a polypeptide sequence having at least about 80%, 85%, about 86%, about 87%, about 88%, about 89%, about 90%, about 91%, about 92%, about 93%, about 94%, about 95%, about 96%, about 97%, about 98%, about 99%, or more sequence identity to at least one sequence set forth in the even-numbered sequences of SEQ ID NOS: 4-18, 22-966, and 970-1914. In some further embodiments, the recombinant amylase comprises a polypeptide sequence having at least 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99%, or more sequence identity to at least one sequence set forth in the even-numbered sequences of SEQ ID NOS: 4-18, 22-966, and 970-1914. In some additional embodiments, the recombinant amylase comprises at least one sequence set forth in the even-numbered sequences of SEQ ID NOS: 4-18, 22-966, and 970-1914.

[0151] In some embodiments, the recombinant amylase comprises at least one sequence set forth in the even-numbered sequences of SEQ ID NOS: 22-124 and 970-1072. In some embodiments, the recombinant amylase comprises at least one sequence set forth in the even-numbered sequences of SEQ ID NOS: 126-172 and 1074-1120. In some embodiments, the recombinant amylase comprises at least one sequence set forth in the even-numbered sequences of SEQ ID NOS: 174-222 and 1122-1170. In some embodiments, the recombinant amylase comprises at least one sequence set forth in the even-numbered sequences of SEQ ID NOS: 224-306 and 1172- 1254. In some embodiments, the

recombinant amylase comprises at least one sequence set forth in the even-numbered sequences of SEQ ID NOS: 308-380 and 1256- 1328. In some embodiments, the recombinant amylase comprises at least one sequence set forth in the even-numbered sequences of SEQ ID NOS: 382-440 and 1330-1388. In some embodiments, the recombinant amylase comprises at least one sequence set forth in the even-numbered sequences of SEQ ID NOS: 442-540 and 1390-1488. In some embodiments, the recombinant amylase comprises at least one sequence set forth in the even-numbered sequences of SEQ ID NOS: 542-608 and 1490-1556. In some embodiments, the recombinant amylase comprises at least one sequence set forth in the even-numbered sequences of SEQ ID NOS: 610-660 and 1558-1608. In some embodiments, the recombinant amylase comprises at least one sequence set forth in the even-numbered sequences of SEQ ID NOS: 662-746 and 1610-1694. In some embodiments, the recombinant amylase comprises at least one sequence set forth in the even-numbered sequences of SEQ ID NOS: 748-798 and 1696-1746. In some embodiments, the recombinant amylase comprises at least one sequence set forth in the even-numbered sequences of SEQ ID NOS: 800-820 and 1748-1768. In some embodiments, the recombinant amylase comprises at least one sequence set forth in the even-numbered sequences of SEQ ID NOS: 822-966 and 1770- 1914.

[0152] In some embodiments, the engineered amylase polypeptide comprises a functional fragment of an engineered amylase polypeptide encompassed by the invention. Functional fragments have at least 80%, 81%, 82%, 83%, 84%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, or 99% of the activity of the engineered amylase polypeptide from which is was derived (i.e., the parent engineered amylase). In some embodiments, a functional fragment comprises at least 80%, 81%, 82%, 83%, 84%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98% and even 99% of the parent sequence of the engineered amylase. In some embodiments the functional fragment is truncated by less than 5, less than 10, less than 15, less than 10, less than 25, less than 30, less than 35, less than 40, less than 45, and less than 50 amino acids.

[0153] In some additional embodiments, the recombinant amylase retains more enzymatic activity after exposure to high and/or low temperatures, as compared to a reference sequence. In some embodiments, the reference sequence is wild-type amylase, while in some other embodiments, the reference sequence is another recombinant amylase. In some additional embodiments, the recombinant amylase is more thermostable than the amylase of SEQ ID NO: 2. In some further embodiments, the recombinant amylase is more thermostable than the amylase of SEQ ID NO: 18, 40, 156, 174, 276, 308, 422, 456, 546, 632, 664, 780, 988, 1104, 1122, 1224, 1256, 1370, 1404, 1494, 1580, 1612, and/or 1728. In some embodiments, the recombinant amylase is stable at 30°C, 37°C, 40°C, 50°C, 60°C, and/or 95°C, and/or 40°C to 60°C. In some embodiments, the recombinant amylase is stable at 30°C, 37°C, 42°C, and/or 48°C. In some additional embodiments, the recombinant amylase is more stable than a reference sequence at 30°C, 37°C, 40°C, 50°C, 60°C, and/or 95°C, and/or 40°C to 60°C. In some embodiments, the recombinant amylase is more stable

than a reference sequence at 30°C, 37°C, 40°C, 50°C, 60°C, and/or 95°C, and/or 40°C to 60°C. In some additional embodiments, the recombinant amylase is more thermostable than the amylase of SEQ ID NO: 2. In some further embodiments, the recombinant amylase is more thermostable than the amylase of SEQ ID NO: 18, 40, 156, 174, 276, 308, 422, 456, 546, 632, 664, 780, 988, 1104, 1122, 1224, 1256, 1370, 1404, 1494, 1580, 1612, and/or 1728.

[0154] In some embodiments, the recombinant amylase is stable in low pH environments, while in other embodiments, the recombinant amylase is stable in high pH environments, and in still further embodiments, the recombinant is stable in neutral pH environments. In some embodiments, the recombinant amylase is stable in low, high, and/or neutral pH environments. In some embodiments, the recombinant amylase retains enzymatic activity after exposure to a low, high, and/or neutral pH environment. In some additional embodiments, the recombinant amylase is more stable in high, low, and/or neutral pH environment(s), as compared to a reference sequence. In some embodiments, the reference sequence is wild-type amylase, while in other embodiments, the reference sequence is another engineered amylase. In some additional embodiments, the recombinant amylase is more stable than the amylase of SEQ ID NO: 2. In some further embodiments, the recombinant amylase is more stable than the amylase of SEQ ID NO: 18, 40, 156, 174, 276, 308, 422, 456, 546, 632, 664, 780, 988, 1104, 1122, 1224, 1256, 1370, 1404, 1494, 1580, 1612, and/or 1728. In some additional embodiments, the recombinant amylase is more stable at pHs greater than 7, than the amylase of SEQ ID NO: 2. In some additional embodiments, the recombinant amylase is more stable at pHs greater than 7, than the amylase of SEQ ID NO: 18, 40, 156, 174, 276, 308, 422, 456, 546, 632, 664, 780, 988, 1104, 1122, 1224, 1256, 1370, 1404, 1494, 1580, 1612, and/or 1728. In some additional embodiments, the recombinant amylase is more stable at pH 7.8, than the amylase of SEQ ID NO: 2. In some additional embodiments, the recombinant amylase is more stable at pH 7.8, than the amylase of SEQ ID NO: 18, 40, 156, 174, 276, 308, 422, 456, 546, 632, 664, 780, 988, 1104, 1122, 1224, 1256, 1370, 1404, 1494, 1580, 1612, and/or 1728. In some additional embodiments, the recombinant amylase is more stable at pH 7.5, than the amylase of SEQ ID NO: 2. In some additional embodiments, the recombinant amylase is more stable at pH 7.5, than the amylase of SEQ ID NO: 18, 40, 156, 174, 276, 308, 422, 456, 546, 632, 664, 780, 988, 1104, 1122, 1224, 1256, 1370, 1404, 1494, 1580, 1612, and/or 1728. In some additional embodiments, the recombinant amylase is more stable at pH 7, than the amylase of SEQ ID NO: 2. In some additional embodiments, the recombinant amylase is more stable at pH 7, than the amylase of SEQ ID NO: 18, 40, 156, 174, 276, 308, 422, 456, 546, 632, 664, 780, 988, 1104, 1122, 1224, 1256, 1370, 1404, 1494, 1580, 1612, and/or 1728. In some further embodiments, the recombinant amylase is more stable at pHs less than 7, than the amylase of SEQ ID NO: 2. In some additional embodiments, the recombinant amylase is more stable at pHs less than pH 7, than the amylase of SEQ ID NO: 18, 40, 156, 174, 276, 308, 422, 456, 546, 632, 664, 780, 988, 1104, 1122, 1224, 1256, 1370, 1404, 1494, 1580, 1612, and/or 1728. In some additional

embodiments, the recombinant amylase is more stable at pH 6.8, than the amylase of SEQ ID NO: 2. In some additional embodiments, the recombinant amylase is more stable at pH 6.8, than the amylase of SEQ ID NO: 18, 40, 156, 174, 276, 308, 422, 456, 546, 632, 664, 780, 988, 1104, 1122, 1224, 1256, 1370, 1404, 1494, 1580, 1612, and/or 1728. In some additional embodiments, the recombinant amylase is more stable at pH 6.7, than the amylase of SEQ ID NO: 2. In some additional embodiments, the recombinant amylase is more stable at pH 6.7, than the amylase of SEQ ID NO: 18, 40, 156, 174, 276, 308, 422, 456, 546, 632, 664, 780, 988, 1104, 1122, 1224, 1256, 1370, 1404, 1494, 1580, 1612, and/or 1728. In some additional embodiments, the recombinant amylase is more stable at pH 6.5, than the amylase of SEQ ID NO: 2. In some additional embodiments, the recombinant amylase is more stable at pH 6.5, than the amylase of SEQ ID NO: 18, 40, 156, 174, 276, 308, 422, 456, 546, 632, 664, 780, 988, 1104, 1122, 1224, 1256, 1370, 1404, 1494, 1580, 1612, and/or 1728. In some additional embodiments, the recombinant amylase is more stable at pH 6, than the amylase of SEQ ID NO: 2. In some additional embodiments, the recombinant amylase is more stable at pH 6, than the amylase of SEQ ID NO: 18, 40, 156, 174, 276, 308, 422, 456, 546, 632, 664, 780, 988, 1104, 1122, 1224, 1256, 1370, 1404, 1494, 1580, 1612, and/or 1728. In some further embodiments, the recombinant amylase is more stable at pHs less than 5, than the amylase of SEQ ID NO: 2. In some additional embodiments, the recombinant amylase is more stable at pH 5, than the amylase of SEQ ID NO: 2. In some additional embodiments, the recombinant amylase is more stable at pH 5, than the amylase of SEQ ID NO: 18, 40, 156, 174, 276, 308, 422, 456, 546, 632, 664, 780, 988, 1104, 1122, 1224, 1256, 1370, 1404, 1494, 1580, 1612, and/or 1728. In some further embodiments, the recombinant amylase is more stable at pH 4, than the amylase of SEQ ID NO: 2. In some further embodiments, the recombinant amylase is more stable at pH 5, than the amylase of SEQ ID NO: 18, 40, 156, 174, 276, 308, 422, 456, 546, 632, 664, 780, 988, 1104, 1122, 1224, 1256, 1370, 1404, 1494, 1580, 1612, and/or 1728. In some additional embodiments, the recombinant amylase is more stable at pH 3.8, than the amylase of SEQ ID NO: 2. In some additional embodiments, the recombinant amylase is more stable at pH 3.8, than the amylase of SEQ ID NO: 18, 40, 156, 174, 276, 308, 422, 456, 546, 632, 664, 780, 988, 1104, 1122, 1224, 1256, 1370, 1404, 1494, 1580, 1612, and/or 1728.

[0155] In some additional embodiments, the recombinant amylase is more stable at pH 3.5, than the amylase of SEQ ID NO: 2. In some additional embodiments, the recombinant amylase is more stable at pH 3.5, than the amylase of SEQ ID NO: 18, 40, 156, 174, 276, 308, 422, 456, 546, 632, 664, 780, 988, 1104, 1122, 1224, 1256, 1370, 1404, 1494, 1580, 1612, and/or 1728. In some additional embodiments, the recombinant amylase is more stable at pH 3.25, than the amylase of SEQ ID NO: 2. In some additional embodiments, the recombinant amylase is more stable at pH 3.25, than the amylase of SEQ ID NO: 18, 40, 156, 174, 276, 308, 422, 456, 546, 632, 664, 780, 988, 1104, 1122, 1224, 1256, 1370, 1404, 1494, 1580, 1612, and/or 1728. In some further embodiments, the recombinant amylase is more stable at pH 3, than the amylase of SEQ ID NO: 2. In some further

embodiments, the recombinant amylase is more stable at pH 3, than the amylase of SEQ ID NO: 18, 40, 156, 174, 276, 308, 422, 456, 546, 632, 664, 780, 988, 1104, 1122, 1224, 1256, 1370, 1404, 1494, 1580, 1612, and/or 1728. In some additional embodiments, the recombinant amylase is more stable at pH 2.75, than the amylase of SEQ ID NO: 2. In some additional embodiments, the recombinant amylase is more stable at pH 2.75, than the amylase of SEQ ID NO: 18, 40, 156, 174, 276, 308, 422, 456, 546, 632, 664, 780, 988, 1104, 1122, 1224, 1256, 1370, 1404, 1494, 1580, 1612, and/or 1728. In some further embodiments, the recombinant amylase is more stable at pH 2.5, than the amylase of SEQ ID NO: 2. In some further embodiments, the recombinant amylase is more stable at pH 2.5, than the amylase of SEQ ID NO: 18, 40, 156, 174, 276, 308, 422, 456, 546, 632, 664, 780, 988, 1104, 1122, 1224, 1256, 1370, 1404, 1494, 1580, 1612, and/or 1728. In some further embodiments, the recombinant amylase is more stable at pH 2.3, than the amylase of SEQ ID NO: 2. In some further embodiments, the recombinant amylase is more stable at pH 2.3, than the amylase of SEQ ID NO: 18, 40, 156, 174, 276, 308, 422, 456, 546, 632, 664, 780, 988, 1104, 1122, 1224, 1256, 1370, 1404, 1494, 1580, 1612, and/or 1728. In some further embodiments, the recombinant amylase is more stable at pH 2, than the amylase of SEQ ID NO: 2. In some further embodiments, the recombinant amylase is more stable at pH 2, than the amylase of SEQ ID NO: 18, 40, 156, 174, 276, 308, 422, 456, 546, 632, 664, 780, 988, 1104, 1122, 1224, 1256, 1370, 1404, 1494, 1580, 1612, and/or 1728.

[0156] In some embodiments, the recombinant amylase is more resistant to proteolysis than the amylase of SEQ ID NO: 2. In some embodiments, the recombinant amylase is more resistant to proteolysis than the amylase of SEQ ID NO: 18, 40, 156, 174, 276, 308, 422, 456, 546, 632, 664, 780, 988, 1104, 1122, 1224, 1256, 1370, 1404, 1494, 1580, 1612, and/or 1728. In some embodiments, the recombinant amylase is resistant to proteolysis by pepsin. In some additional embodiments, the recombinant amylase is more resistant to proteolysis by pepsin than the amylase of SEQ ID NO: 2. In some embodiments, the recombinant amylase is more resistant to proteolysis by pepsin than the amylase of SEQ ID NO: 18, 40, 156, 174, 276, 308, 422, 456, 546, 632, 664, 780, 988, 1104, 1122, 1224, 1256, 1370, 1404, 1494, 1580, 1612, and/or 1728. In some additional embodiments, the recombinant amylase is resistant to proteolysis by trypsin. In some additional embodiments, the recombinant amylase is more resistant to proteolysis by trypsin than the amylase of SEQ ID NO: 2. In some embodiments, the recombinant amylase is more resistant to proteolysis by trypsin than the amylase of SEQ ID NO: 18, 40, 156, 174, 276, 308, 422, 456, 546, 632, 664, 780, 988, 1104, 1122, 1224, 1256, 1370, 1404, 1494, 1580, 1612, and/or 1728. In some embodiments, the recombinant amylase is resistant to proteolysis by chymotrypsin. In some additional embodiments, the recombinant amylase is more resistant to proteolysis by chymotrypsin than the amylase of SEQ ID NO: 2. In some embodiments, the recombinant amylase is more resistant to proteolysis by chymotrypsin than the amylase of SEQ ID NO: 18, 40, 156, 174, 276, 308, 422, 456, 546, 632, 664, 780, 988, 1104, 1122, 1224, 1256, 1370, 1404, 1494, 1580, 1612, and/or 1728. In some further

embodiments, the recombinant amylase is resistant to proteolysis by pepsin, trypsin, and/or chymotrypsin. In some additional embodiments, the recombinant amylase is more resistant to proteolysis by pepsin, trypsin, and/or chymotrypsin, than the amylase of SEQ ID NO: 2. In some embodiments, the recombinant amylase is more resistant to proteolysis by pepsin, trypsin, and/or chymotrypsin, than the amylase of SEQ ID NO: 18, 40, 156, 174, 276, 308, 422, 456, 546, 632, 664, 780, 988, 1104, 1122, 1224, 1256, 1370, 1404, 1494, 1580, 1612, and/or 1728.

[0157] In some additional embodiments, the recombinant amylase is active in the presence of at least one bile salt. In some additional embodiments, the recombinant amylase is more active in the presence of at least one bile salt than the amylase of SEQ ID NO: 2. In some additional embodiments, the recombinant amylase is more active in the presence of at least one bile salt than the amylase of SEQ ID NO: 18, 40, 156, 174, 276, 308, 422, 456, 546, 632, 664, 780. 988, 1104, 1122, 1224, 1256, 1370, 1404, 1494, 1580, 1612, and/or 1728. In some embodiments, the recombinant amylase retains enzymatic activity after exposure to a bile salt. In some additional embodiments, the recombinant amylase retains more enzymatic activity after exposure to a bile salt, as compared to a reference sequence. In some embodiments, the reference sequence is the amylase of SEQ ID NO: 2, 18, 40, 156, 174, 276, 308, 422, 456, 546, 632, 664, 780, 988, 1104, 1122, 1224, 1256, 1370, 1404, 1494, 1580, 1612, and/or 1728. In some additional embodiments, the bile salt is taurocholate.

[0158] In yet some additional embodiments, the recombinant amylase exhibits more than one improved property, as compared to wild-type amylase or another recombinant amylase. In some embodiments, the recombinant amylase exhibits more than one improved property as compared to SEQ ID NO:2, while in some additional embodiments, the recombinant amylase exhibits more than one improved property as compared to SEQ ID NO: 18, 40, 156, 174, 276, 308, 422, 456, 546, 632, 664, 780, 988, 1104, 1122, 1224, 1256, 1370, 1404, 1494, 1580, 1612, and/or 1728. In some embodiments, the improved properties are selected from acid stability, alkaline stability, stability and/or activity at acidic pH, stability at alkaline pH, stability at neutral pH, thermostability, proteolysis resistance, and increased activity in the presence of at least one bile salt. In yet some additional embodiments, the recombinant amylase is more stable and/or active at acidic pHs, more thermostable, more resistant to proteolysis, and/or more active in the presence of at least one bile salt than the amylase of SEQ ID NO: 2, 18, 40, 156, 174, 276, 308, 422, 456, 546, 632, 664, 780, 988, 1104, 1122, 1224, 1256, 1370, 1404, 1494, 1580, 1612, and/or 1728. It is contemplated that any combination of improved properties will find use in the present invention. It is not intended that the present invention be limited to any specific combination of improved properties. Furthermore, in some embodiments, there are two improved properties, while in some other embodiments, there are three improved properties, in some additional embodiments, there are four improved properties, and in some additional embodiments, there are five or more improved properties. It is also contemplated that the recombinant amylase of the present invention furthers comprise additional improvements. In

some embodiments, these additional improvements provide advantages over wild-type amylase, while in some other embodiments, the additional improvements will provide advantages over other recombinant amylases.

[0159] In some embodiments, the recombinant amylase exhibits at least one improved property selected from improved stability and/or activity at acidic pHs, improved thermostability, improved resistance to proteolysis, and/or improved activity in the presence of at least one bile salt, as compared to the amylase of SEQ ID NO: 2. In some embodiments, the recombinant amylase exhibits at least one improved property selected from improved stability and/or activity at acidic pHs, improved thermostability, improved resistance to proteolysis, and/or improved activity in the presence of at least one bile salt, as compared to the amylase of SEQ ID NO: 18, 40, 156, 174, 276, 308, 422, 456, 546, 632, 664, 780, 988, 1104, 1122, 1224, 1256, 1370, 1404, 1494, 1580, 1612, and/or 1728. In some embodiments, the recombinant amylase exhibits at least two improved properties selected from improved stability and/or activity at acidic pHs, improved thermostability, improved resistance to proteolysis, and/or improved activity in the presence of at least one bile salt, as compared to the amylase of SEQ ID NO: 2. In some embodiments, the recombinant amylase exhibits at least two improved properties selected from improved stability and/or activity at acidic pHs, improved thermostability, improved resistance to proteolysis, and/or improved activity in the presence of at least one bile salt, as compared to the amylase of SEQ ID NO: 18, 40, 156, 174, 276, 308, 422, 456, 546, 632, 664, 780, 988, 1104, 1122, 1224, 1256, 1370, 1404, 1494, 1580, 1612, and/or 1728. In some embodiments, the recombinant amylase exhibits at least three improved properties selected from improved stability and/or activity at acidic pHs, improved thermostability, improved resistance to proteolysis, and/or improved activity in the presence of at least one bile salt, as compared to the amylase of SEQ ID NO: 2. In some embodiments, the recombinant amylase exhibits at least three improved properties selected from improved stability and/or activity at acidic pHs, improved thermostability, improved resistance to proteolysis, and/or improved activity in the presence of at least one bile salt, as compared to the amylase of SEQ ID NO: 18, 40, 156, 174, 276, 308, 422, 456, 546, 632, 664, 780, 988, 1104, 1122, 1224, 1256, 1370, 1404, 1494, 1580, 1612, and/or 1728. In some embodiments, the recombinant amylase exhibits the improved properties of improved stability and/or activity at acidic pHs, improved thermostability, improved resistance to proteolysis, and improved activity in the presence of at least one bile salt, as compared to the amylase of SEQ ID NO: 2. In some embodiments, the recombinant amylase exhibits the improved properties of improved stability and/or activity at acidic pHs, improved thermostability, improved resistance to proteolysis, and/or improved activity in the presence of at least one bile salt, as compared to the amylase of SEQ ID NO: 18, 40, 156, 174, 276, 308, 422, 456, 546, 632, 664, 780, 988, 1104, 1122, 1224, 1256, 1370, 1404, 1494, 1580, 1612, and/or 1728. In some embodiments, the recombinant amylase exhibits at least one improved property selected from improved stability and/or activity at acidic pHs, improved

thermostability, improved resistance to proteolysis, and/or improved activity in the presence of at least one bile salt, as well as at least one additional improved property, as compared to the amylase of SEQ ID NO: 2. In some embodiments, the recombinant amylase exhibits at least one improved property selected from improved stability and/or activity at acidic pHs, improved thermostability, improved resistance to proteolysis, and/or improved activity in the presence of at least one bile salt, as well as at least one additional improved property, as compared to the amylase of SEQ ID NO: 18, 40, 156, 174, 276, 308, 422, 456, 546, 632, 664, 780, 988, 1104, 1122, 1224, 1256, 1370, 1404, 1494, 1580, 1612, and/or 1728. In some embodiments, the recombinant amylase exhibits at least one improved property selected from: i) enhanced catalytic activity; ii) increased tolerance to acid pH; iii) increased tolerance to pH 2.3, 2.5, 2.75, 3, 3.25, and/or 3.5; iv) increased tolerance to pH 6.7 and/or 6.8; v) increased tolerance to at least one protease; vi) increased tolerance to at least one bile salt; vii) increased thermotolerance; or a combination of any of i), ii), iii), iv), v), vi), and vii) as compared to a reference sequence. In some embodiments, the reference sequence is SEQ ID NO: 2, while in some alternative embodiments, the reference sequence is selected from SEQ ID NO: 18, 40, 156, 174, 276, 308, 422, 456, 546, 632, 664, 780, 988, 1104, 1122, 1224, 1256, 1370, 1404, 1494, 1580, 1612, and/or 1728. In some embodiments, the recombinant amylase exhibits at least one improved property selected from: i) enhanced catalytic activity; ii) increased tolerance to acid pH; iii) increased tolerance to pH 2.3, 2.5, 2.75, 3, 3.25, and/or 3.5; iv) increased tolerance to pH 6.7 and/or 6.8; v) increased tolerance to at least one protease; vi) increased tolerance to at least one bile salt; vii) increased thermotolerance; or a combination of any of i), ii), iii), iv), v), vi), and vii) as compared to at least one reference sequence. In some embodiments, the reference sequence is SEQ ID NO: 2, while in some alternative embodiments, the reference sequence is selected from SEQ ID NO: 18, 40, 156, 174, 276, 308, 422, 456, 546, 632, 664, 780, 988, 1104, 1122, 1224, 1256, 1370, 1404, 1494, 1580, 1612, and/or 1728. In some embodiments, the recombinant amylase exhibits at least one improved property selected from: i) enhanced catalytic activity; ii) increased tolerance to acid pH; iii) increased tolerance to pH 2.3, 2.5, 2.75, 3, 3.25, and/or 3.5; iv) increased tolerance to pH 6.7 and/or 6.8; v) increased tolerance to at least one protease; vi) increased tolerance to at least one bile salt; vii) increased thermotolerance; or a combination of any of i), ii), iii), iv), v), vi), and vii) as compared to at least two or more reference sequences. In some embodiments, the reference sequence is selected from SEQ ID NO: 18, 40, 156, 174, 276, 308, 422, 456, 546, 632, 664, 780, 988, 1104, 1122, 1224, 1256, 1370, 1404, 1494, 1580, 1612, and/or 1728. In some further embodiments, the recombinant amylase is purified.

[0160] The present invention further provides methods starch hydrolysis, comprising providing starch and at least one engineered amylase provided herein; and exposing the starch to the engineered amylase under conditions such that the starch is hydrolyzed by said engineered amylase.

[0161] In still some further embodiments, the amylase is stable in food and/or beverages. In some additional embodiments, the amylase is stable in nutritional and other supplements. In some

embodiments, the supplements are liquid, while in other embodiments, they are emulsions, suspensions, or solids. It is not intended that the present invention be limited to any particular food, beverage, and/or supplement format or form.

Polynucleotides Encoding Engineered Polypeptides, Expression Vectors and Host Cells

[0162] The present invention provides polynucleotides encoding the engineered amylase polypeptides described herein. In some embodiments, the polynucleotides are operatively linked to one or more heterologous regulatory sequences that control gene expression to create a recombinant polynucleotide capable of expressing the polypeptide. Expression constructs containing a heterologous polynucleotide encoding the engineered amylase polypeptides can be introduced into appropriate host cells to express the corresponding amylase polypeptide.

[0163] As will be apparent to the skilled artisan, availability of a protein sequence and the knowledge of the codons corresponding to the various amino acids provide a description of all the polynucleotides capable of encoding the subject polypeptides. The degeneracy of the genetic code, where the same amino acids are encoded by alternative or synonymous codons, allows an extremely large number of nucleic acids to be made, all of which encode the engineered amylase polypeptide. Thus, having knowledge of a particular amino acid sequence, those skilled in the art could make any number of different nucleic acids by simply modifying the sequence of one or more codons in a way which does not change the amino acid sequence of the protein. In this regard, the present invention specifically contemplates each and every possible variation of polynucleotides that could be made encoding the polypeptides described herein by selecting combinations based on the possible codon choices, and all such variations are to be considered specifically disclosed for any polypeptide described herein, including the variants provided in Table 4-1, 4-2, 4-3, 4-4, 4-5, 4-6, 4-7, 4-8, 4-9, 4-10, 4-11, 4-12, 4-13, and/or 4-14; and variants provided in Table 4-1, 4-2, 4-3, 4-4, 4-5, 4-6, 4-7, 4-8, 4-9, 4-10, 4-11, 4-12, 4-13, and/or 4-14, where the variants are absent the histidine tag and preceding amino acid linker.

[0164] In various embodiments, the codons are preferably selected to fit the host cell in which the protein is being produced. For example, preferred codons used in bacteria are used for expression in bacteria, while preferred codons used in fungi are used for expression in fungi. Consequently, codon optimized polynucleotides encoding the engineered amylase polypeptides contain preferred codons at about 40%, 50%, 60%, 70%, 80%, or greater than 90% of codon positions of the full length coding region.

[0165] In some embodiments, the present invention provides a recombinant polynucleotide sequence having at least about 80%, at least about 85%, about 86%, about 87%, about 88%, about 89%, about 90%, about 91%, about 92%, about 93%, about 94%, about 95%, about 96%, about 97%, about 98%, about 99%, or more sequence identity to SEQ ID NO: 1, 17, 39, 155, 173, 275, 307, 421, 455, 545,

631, 663, 779, 987, 1103, 1121, 1223, 1255, 1369, 1403, 1493, 1579, 1611, and/or 1727. In some embodiments, the present invention provides a recombinant polynucleotide sequence having at least 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99%, or more sequence identity to SEQ ID NO: 1, 17, 39, 155, 173, 275, 307, 421, 455, 545, 631, 663, 779, 987, 1103, 1121, 1223, 1255, 1369, 1403, 1493, 1579, 1611, and/or 1727. In some embodiments, the recombinant polynucleotide sequence has at least 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99% or more sequence identity to the odd-numbered sequences of SEQ ID NOS: 3-17, 21-965, and 969-1913. In some embodiments, the polynucleotide encoding the engineered amylase polypeptides comprises the polynucleotide sequence of SEQ ID NO: 1, 17, 39, 155, 173, 275, 307, 421, 455, 545, 631, 663, 779, 987, 1103, 1121, 1223, 1255, 1369, 1403, 1493, 1579, 1611, or 1727. In some embodiments, the polynucleotide encoding the engineered amylase polypeptides comprises the polynucleotide sequence of odd-numbered sequences of SEQ ID NOS: 3-17, 21-965, and 969-1913.

[0166] In some embodiments, as described herein, the polynucleotide encodes an engineered polypeptide having amylase activity with the properties disclosed herein, wherein the polypeptide comprises an amino acid sequence having at least 80%, 81%, 82%, 83%, 84%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99% or more identity to: a reference sequence (e.g., SEQ ID NO: 2, 18, 40, 156, 174, 276, 308, 422, 456, 546, 632, 664, 780, 988, 1104, 1122, 1224, 1256, 1370, 1404, 1494, 1580, 1612, and/or 1728), or the amino acid sequence of any variant as disclosed in Table 4-1, 4-2, 4-3, 4-4, 4-5, 4-6, 4-7, 4-8, 4-9, 4-10, 4-11, 4-12, 4-13, and/or 4-14; or the amino acid sequence of any variant as disclosed in Table 4-1, 4-2, 4-3, 4-4, 4-5, 4-6, 4-7, 4-8, 4-9, 4-10, 4-11, 4-12, 4-13, and/or 4-14, wherein the variant is lacking the histidine tag and preceding amino acid linker, and one or more residue differences as compared to the reference polypeptide of SEQ ID NO: 2, 18, 40, 156, 174, 276, 308, 422, 456, 546, 632, 664, 780, 988, 1104, 1122, 1224, 1256, 1370, 1404, 1494, 1580, 1612, and/or 1728; or the amino acid sequence of any variant as disclosed in Table 4-1, 4-2, 4-3, 4-4, 4-5, 4-6, 4-7, 4-8, 4-9, 4-10, 4-11, 4-12, 4-13, and/or 4-14, or the amino acid sequence of any variant as disclosed in the Tables (for example 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, or more amino acid residue positions), with or without a histidine tag and preceding amino acid linker. In some embodiments, the polynucleotide encodes an engineered polypeptide having amylase activity with the properties disclosed herein, wherein the polypeptide comprises an amino acid sequence having at least 80%, 81%, 82%, 83%, 84%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99% or more sequence identity to reference sequence SEQ ID NO: 2, 18, 40, 156, 174, 276, 308, 422, 456, 546, 632, 664, 780, 988, 1104, 1122, 1224, 1256, 1370, 1404, 1494, 1580, 1612, and/or 1728, and one or more residue differences as compared to SEQ ID NO: 2, 18, 40, 156, 174, 276, 308, 422, 456, 546, 632, 664, 780, 988, 1104, 1122, 1224, 1256, 1370, 1404, 1494, 1580, 1612,

and/or 1728, at residue positions selected from those provided in Table 4-1, 4-2, 4-3, 4-4, 4-5, 4-6, 4-7, 4-8, 4-9, 4-10, 4-11, 4-12, 4-13, and/or 4-14, when optimally aligned with the polypeptide of SEQ ID NO: 2, 18, 40, 156, 174, 276, 308, 422, 456, 546, 632, 664, 780, 988, 1104, 1122, 1224, 1256, 1370, 1404, 1494, 1580, 1612, and/or 1728.

[0167] In some embodiments, the polynucleotide encodes a recombinant amylase comprising a polypeptide sequence having at least 70%, 75%, 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99%, or more sequence identity to SEQ ID NO: 2 or 18, or a functional fragment thereof.

[0168] In some embodiments, the polynucleotide encodes a recombinant amylase comprising a polypeptide sequence having at least 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99%, or more sequence identity to SEQ ID NO: 2 or 18, or a functional fragment thereof, and wherein the encoded recombinant amylase comprises at least one substitution or substitution set at one or more positions selected from 2/73/256/493, 16/33/73/130/256/282/371/374/493, 16/33/130/256/302/371/383/470, 16/33/157/256/302/371/383, 16/73/74/256/282/366/371/383/493, 16/73/256/282/302/331/371/383, 16/130/256/276/374/470, 16/256/302/374, 19/72/345/473, 26/27/396/412/428/473, 26/27/412, 26/27/466/473, 29, 73/130/256/282/302/493, 74/371/374/383/493, 130/256/493, 149, 158, 254, 256, 256/383, 257, 259, 272, 279, 284, 317/383, 322, 345/388/396/428, 388/396/412/428, 396/412, 396/412/428/466, 409, 412, and 495, wherein the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 2 or 18. In some embodiments, the encoded recombinant amylase comprises at least one substitution or substitution set selected from 2K/73V/256S/493D, 16D/33E/73V/130D/256S/282D/371F/374S/493D, 16D/33E/130D/256S/302Q/371F/383E/470T, 16D/33E/157Y/256S/302Q/371F/383E, 16D/73V/74A/256S/282D/366L/371F/383E/493D, 16D/73V/256S/282D/302Q/331P/371F/383E, 16D/130D/256S/276Q/374S/470T, 16D/256S/302Q/374S, 19E/72T/345A/473D, 26A/27L/396H/412D/428E/473D, 26A/27L/412D, 26A/27L/466E/473D, 29G, 29R, 29S, 73V/130D/256S/282D/302Q/493D, 74A/371F/374S/383E/493D, 130D/256S/493D, 149R, 149T, 158R, 254G, 254S, 256S, 256S/383E, 257E, 257G, 257R, 257S, 257V, 259Q, 272G, 272K, 272P, 272R, 272S, 279R, 284C, 284R, 284S, 284Y, 317G/383L, 322A, 345A/388E/396H/428E, 388E/396H/412D/428E, 396H/412D, 396H/412D/428E/466E, 409S, 412S, 495E, 495L, and 495Y, wherein the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 2 or 18. In some embodiments, the encoded recombinant amylase comprises at least one substitution or substitution set selected from R2K/I73V/A256S/E493D, E16D/D33E/I73V/E130D/A256S/E282D/Y371F/H374S/E493D, E16D/D33E/E130D/A256S/M302Q/Y371F/Q383E/V470T, E16D/D33E/F157Y/A256S/M302Q/Y371F/Q383E, E16D/I73V/P74A/A256S/E282D/F366L/Y371F/Q383E/E493D,

E16D/I73V/A256S/E282D/M302Q/H331P/Y371F/Q383E, E16D/E130D/A256S/T276Q/H374S/V470T, E16D/A256S/M302Q/H374S, K19E/S72T/P345A/E473D, E26A/R27L/D396H/L412D/D428E/E473D, E26A/R27L/L412D, E26A/R27L/Q466E/E473D, D29G, D29R, D29S, I73V/E130D/A256S/E282D/M302Q/E493D, P74A/Y371F/H374S/Q383E/E493D, E130D/A256S/E493D, Q149R, Q149T, K158R, E254G, E254S, A256S, A256S/Q383E, P257E, P257G, P257R, P257S, P257V, P259Q, D272G, D272K, D272P, D272R, D272S, D279R, K284C, K284R, K284S, K284Y, V317G/Q383L, F322A, P345A/D388E/D396H/D428E, D388E/D396H/L412D/D428E, D396H/L412D, D396H/L412D/D428E/Q466E, V409S, L412S, I495E, I495L, and I495Y, wherein the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 2 or 18.

[0169] In some embodiments, the polynucleotide encodes a recombinant amylase comprising a polypeptide sequence having at least 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99%, or more sequence identity to SEQ ID NO: 40 or 988, or a functional fragment thereof, and wherein the encoded recombinant amylase comprises at least one substitution or substitution set at one or more positions selected from 26/29/158/272/412, 26/29/272/279/412/493, 26/29/272/396/412, 26/29/279/412/428, 26/158/272/279/388/412/428, 26/158/272/412, 26/272/279/412/428/493, 29/272/279/396/412, 130/149/254/284/322/409/495, 130/149/257/284/322/409/466/473, 130/254/284/322/374/409/466, 130/257/284/374/409/466, 130/284/322/374/409/473, 149/257/284/322/409/466, 158/272/279/394/396/412/428/493, 158/272/388/412/428/493, 158/272/412/428, 158/279/388/396/412/428, 254/257/284/322/409/473, 254/284/409/466/495, 272/279/412/428/493, 272/412/428, 272/412/493, and 284/322/409/473, wherein the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 40 or 988. In some embodiments, the encoded recombinant amylase comprises at least one substitution or substitution set selected from 26A/29R/158R/272G/412D, 26A/29R/272G/279R/412D/493D, 26A/29R/272G/396H/412D, 26A/29R/279R/412D/428E, 26A/158R/272G/279R/388E/412D/428E, 26A/158R/272G/412D, 26A/272G/279R/412D/428E/493D, 29R/272G/279R/396H/412D, 130D/149R/254S/284S/322A/409S/495E, 130D/149R/257G/284S/322A/409S/466E/473D, 130D/254S/284S/322A/374S/409S/466E, 130D/257G/284S/374S/409S/466E, 130D/284S/322A/374S/409S/473D, 149R/257G/284S/322A/409S/466E, 158R/272G/279R/394R/396H/412D/428E/493D, 158R/272G/388E/412D/428E/493D, 158R/272G/412D/428E, 158R/279R/388E/396H/412D/428E, 254S/257G/284S/322A/409S/473D, 254S/284S/409S/466E/495E, 272G/279R/412D/428E/493D, 272G/412D/428E, 272G/412D/493D, and 284S/322A/409S/473D, wherein the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 40 or 988. In some embodiments, the encoded recombinant amylase comprises at least one substitution or substitution set selected from E26A/D29R/K158R/D272G/L412D, E26A/D29R/D272G/D279R/L412D/E493D,

E26A/D29R/D272G/D396H/L412D, E26A/D29R/D279R/L412D/D428E, E26A/K158R/D272G/D279R/D388E/L412D/D428E, E26A/K158R/D272G/L412D, E26A/D272G/D279R/L412D/D428E/E493D, D29R/D272G/D279R/D396H/L412D, E130D/Q149R/E254S/K284S/F322A/V409S/I495E, E130D/Q149R/P257G/K284S/F322A/V409S/Q466E/E473D, E130D/E254S/K284S/F322A/H374S/V409S/Q466E, E130D/P257G/K284S/H374S/V409S/Q466E, E130D/K284S/F322A/H374S/V409S/E473D, Q149R/P257G/K284S/F322A/V409S/Q466E, K158R/D272G/D279R/Q394R/D396H/L412D/D428E/E493D, K158R/D272G/D388E/L412D/D428E/E493D, K158R/D272G/L412D/D428E, K158R/D279R/D388E/D396H/L412D/D428E, E254S/P257G/K284S/F322A/V409S/E473D, E254S/K284S/V409S/Q466E/I495E, D272G/D279R/L412D/D428E/E493D, D272G/L412D/D428E, D272G/L412D/E493D, and K284S/F322A/V409S/E473D, wherein the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 40 or 988.

[0170] In some embodiments, the polynucleotide encodes a recombinant amylase comprising a polypeptide sequence having at least 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99%, or more sequence identity to SEQ ID NO: 156 or 1104, or a functional fragment thereof, and wherein the encoded recombinant amylase comprises at least one substitution or substitution set at one or more positions selected from 37, 51, 91, 111, 112, 114, 122, 124, 128, 140, 167, 171, 183, 194, 276, 280, 298, 397, and 464, wherein the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 156 or 1104. In some embodiments, the encoded recombinant amylase comprises at least one substitution or substitution set selected from 37R, 51R, 91H, 111A, 112Q, 114H, 122P, 122R, 124R, 128W, 140K, 167W, 171I, 183E, 183N, 183V, 194E, 194R, 276A, 276K, 280L, 298K, 298M, 397T, and 464L, wherein the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 156 or 1104. In some embodiments, the encoded recombinant amylase comprises at least one substitution or substitution set selected from N37R, G51R, K91H, E111A, K112Q, A114H, A122P, A122R, D124R, I128W, R140K, E167W, E171I, G183E, G183N, G183V, L194E, L194R, T276A, T276K, Q280L, E298K, E298M, E397T, and N464L, wherein the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 156 or 1104.

[0171] In some embodiments, the polynucleotide encodes a recombinant amylase comprising a polypeptide sequence having at least 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99%, or more sequence identity to SEQ ID NO: 174 or 1122, or a functional fragment thereof, and wherein the encoded recombinant amylase comprises at least one substitution or substitution set at one or more positions selected from 24, 91, 91/122, 91/122/128/130/167/171/409, 91/122/128/130/183/322, 91/122/128/130/194, 91/122/128/130/322, 91/122/128/171/183/194/322, 91/122/128/183/409, 91/122/130/167/183/194/409, 91/122/130/171/183, 91/122/130/183/194,

91/122/130/194, 91/122/130/194/322, 91/122/167/171/194, 91/122/167/171/194/322, 91/122/171/183/194/409, 91/130/171/183/322/409, 91/167/171, 91/167/183/194, 91/167/322, 91/183, 91/183/322/409, 91/194, 91/322, 91/409, 122/128, 122/128/194/409, 122/130/171/322/409, 122/409, 137/145/227/394/480/481, 137/145/295, 145/227/295/481, 145/309/481, 183, 227, 295/394, 322, 322/409, 394, and 480/481, wherein the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 174 or 1122. In some embodiments, the encoded recombinant amylase comprises at least one substitution or substitution set selected from 24V, 91H, 91H/122P, 91H/122P/130D/183N/194R, 91H/122P/130D/194R/322A, 91H/122R, 91H/122R/128W/130D/167W/171I/409S, 91H/122R/128W/130D/183N/322A, 91H/122R/128W/130D/194R, 91H/122R/128W/130D/322A, 91H/122R/128W/171I/183N/194R/322A, 91H/122R/128W/183N/409S, 91H/122R/130D/167W/183N/194R/409S, 91H/122R/130D/171I/183N, 91H/122R/130D/194R, 91H/122R/167W/171I/194R, 91H/122R/167W/171I/194R/322A, 91H/122R/171I/183N/194R/409S, 91H/130D/171I/183N/322A/409S, 91H/167W/171I, 91H/167W/183N/194R, 91H/167W/322A, 91H/183N, 91H/183N/322A/409S, 91H/194R, 91H/322A, 91H/409S, 122P/409S, 122R/128W, 122R/128W/194R/409S, 122R/130D/171I/322A/409S, 137A/145G/227L/394E/480P/481V, 137A/145G/295N, 145G/227L/295N/481V, 145G/309S/481V, 183N, 227L, 295N/394E, 322A, 322A/409S, 394E, and 480T/481V, wherein the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 174 or 1122. In some embodiments, the encoded recombinant amylase comprises at least one substitution or substitution set selected from L24V, K91H, K91H/A122P, K91H/A122P/E130D/G183N/L194R, K91H/A122P/E130D/L194R/F322A, K91H/A122R, K91H/A122R/I128W/E130D/E167W/E171I/V409S, K91H/A122R/I128W/E130D/G183N/F322A, K91H/A122R/I128W/E130D/L194R, K91H/A122R/I128W/E130D/F322A, K91H/A122R/I128W/E171I/G183N/L194R/F322A, K91H/A122R/I128W/G183N/V409S, K91H/A122R/E130D/E167W/G183N/L194R/V409S, K91H/A122R/E130D/E171I/G183N, K91H/A122R/E130D/L194R, K91H/A122R/E167W/E171I/L194R, K91H/A122R/E167W/E171I/L194R/F322A, K91H/A122R/E171I/G183N/L194R/V409S, K91H/E130D/E171I/G183N/F322A/V409S, K91H/E167W/E171I, K91H/E167W/G183N/L194R, K91H/E167W/F322A, K91H/G183N, K91H/G183N/F322A/V409S, K91H/L194R, K91H/F322A, K91H/V409S, A122P/V409S, A122R/I128W, A122R/I128W/L194R/V409S, A122R/E130D/E171I/F322A/V409S, G137A/A145G/T227L/Q394E/F480P/C481V, G137A/A145G/K295N, A145G/T227L/K295N/C481V, A145G/T309S/C481V, G183N, T227L, K295N/Q394E, F322A, F322A/V409S, Q394E, and F480T/C481V, wherein the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 174 or 1122.

[0172] In some embodiments, the polynucleotide encodes a recombinant amylase comprising a polypeptide sequence having at least 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99%, or more sequence identity to SEQ ID NO: 276 or 1224, or a functional fragment thereof, and wherein the encoded recombinant amylase comprises at least one substitution or substitution set at one or more positions selected from 16/26/29/128/145/256/309/383, 16/26/33/114/145/309/383/394, 16/26/33/128/130/145/302/309/322/371, 16/26/33/145/158/383/394, 16/26/145/302, 16/29/33/145/256/302, 18, 26/29/33/130/145/157/158/183/394, 26/29/33/145/157/183/256/309/383, 26/29/122/130/145/183/256/272/309/394, 26/29/145/157/256/302/322/481, 26/29/145/256/272/302/309/322/481, 26/33/91/145/272/302/481, 26/33/145/309/322/383, 26/114/145/322, 26/145/183/256/309/383, 29/122/145/158/383, 29/130/145/256/272/371/394, 29/145/183/302/309/412, 29/309/394, 33/122/145/272/309/412, 91/130/145/158/183/383, 91/309/383, 130/145/256/272/371, 130/145/302/309, 130/272/481, 145/302/309, 268, 309, 349, 360, 380, 394, 463, and 483, wherein the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 276 or 1224. In some embodiments, the encoded recombinant amylase comprises at least one substitution or substitution set selected from 16E/26E/29D/128I/145G/256A/309S/383Q, 16E/26E/33D/114A/145G/309S/383Q/394E, 16E/26E/33D/128I/130E/145G/302M/309S/322F/371Y, 16E/26E/33D/145G/158K/383Q/394E, 16E/26E/145G/302M, 16E/29D/33D/145G/256A/302M, 18S, 26E/29D/33D/130E/145G/157F/158K/183G/394E, 26E/29D/33D/145G/157F/183G/256A/309S/383Q, 26E/29D/122A/130E/145G/183G/256A/272D/309S/394E, 26E/29D/145G/157F/256A/302M/322F/481V, 26E/29D/145G/256A/272D/302M/309S/322F/481V, 26E/33D/91K/145G/272D/302M/481V, 26E/33D/145G/309S/322F/383Q, 26E/114A/145G/322F, 26E/145G/183G/256A/309S/383Q, 29D/122A/145G/158K/383Q, 29D/130E/145G/256A/272D/371Y/394E, 29D/145G/183G/302M/309S/412L, 29D/309S/394E, 33D/122A/145G/272D/309S/412L, 91K/130E/145G/158K/183G/383Q, 91K/309S/383Q, 130E/145G/256A/272D/371Y, 130E/145G/302M/309S, 130E/272D/481V, 145G/302M/309S, 268T, 309A, 349R, 360G, 380R, 394G, 394N, 394S, 463M, and 483T, wherein the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 276 or 1224. In some embodiments, the encoded recombinant amylase comprises at least one substitution or substitution set selected from D16E/A26E/R29D/W128I/A145G/S256A/T309S/E383Q, D16E/A26E/E33D/H114A/A145G/T309S/E383Q/Q394E, D16E/A26E/E33D/W128I/D130E/A145G/Q302M/T309S/A322F/F371Y, D16E/A26E/E33D/A145G/R158K/E383Q/Q394E, D16E/A26E/A145G/Q302M, D16E/R29D/E33D/A145G/S256A/Q302M, G18S, A26E/R29D/E33D/D130E/A145G/Y157F/R158K/N183G/Q394E, A26E/R29D/E33D/A145G/Y157F/N183G/S256A/T309S/E383Q,

A26E/R29D/R122A/D130E/A145G/N183G/S256A/G272D/T309S/Q394E, A26E/R29D/A145G/Y157F/S256A/Q302M/A322F/C481V, A26E/R29D/A145G/S256A/G272D/Q302M/T309S/A322F/C481V, A26E/E33D/H91K/A145G/G272D/Q302M/C481V, A26E/E33D/A145G/T309S/A322F/E383Q, A26E/H114A/A145G/A322F, A26E/A145G/N183G/S256A/T309S/E383Q, R29D/R122A/A145G/R158K/E383Q, R29D/D130E/A145G/S256A/G272D/F371Y/Q394E, R29D/A145G/N183G/Q302M/T309S/D412L, R29D/T309S/Q394E, E33D/R122A/A145G/G272D/T309S/D412L, H91K/D130E/A145G/R158K/N183G/E383Q, H91K/T309S/E383Q, D130E/A145G/S256A/G272D/F371Y, D130E/A145G/Q302M/T309S, D130E/G272D/C481V, A145G/Q302M/T309S, S268T, T309A, P349R, N360G, G380R, Q394G, Q394N, Q394S, G463M, and G483T, wherein the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 276 or 1224.

[0173] In some embodiments, the polynucleotide encodes a recombinant amylase comprising a polypeptide sequence having at least 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99%, or more sequence identity to SEQ ID NO: 308 or 1256, or a functional fragment thereof, and wherein the encoded recombinant amylase comprises at least one substitution or substitution set at one or more positions selected from 29, 37/124/250/270/349/380/394/442/491, 37/145, 37/145/250/301/349/394, 37/145/258/442/491, 38/349/491, 81/259, 81/313/495, 92/257/258/338/468, 92/258, 94/127/132/145/250/349, 94/270/301/349/394/442, 94/349/491, 145/270, 178, 225, 226, 246, 250/349/442, 259/313/338, 270/349, 286/338, 294, 313, 349, 349/380/442, 413, 413/468, 448, and 473, wherein the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 308 or 1256. In some embodiments, the encoded recombinant amylase comprises at least one substitution or substitution set selected from 29A, 37T/124N/250D/270D/349R/380R/394E/442E/491L, 37T/145G, 37T/145G/250D/301K/349R/394E, 37T/145G/258S/442E/491L, 38I/349R/491L, 81E/259D, 81E/313D/495L, 92E/257E/258Q/338S/468T, 92E/258Q, 94G/127E/132V/145G/250D/349R, 94G/270D/301K/349R/394E/442E, 94G/349R/491L, 145G/270D, 178I, 225D, 226T, 246R, 250D/349R/442E, 259D/313D/338S, 270D/349R, 286T/338S, 294L, 313D, 349R, 349R/380R/442E, 413Y, 413Y/468I, 448T, and 473D, wherein the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 308 or 1256. In some embodiments, the encoded recombinant amylase comprises at least one substitution or substitution set selected from R29A, N37T/D124N/E250D/E270D/P349R/G380R/G394E/D442E/I491L, N37T/A145G, N37T/A145G/E250D/R301K/P349R/G394E, N37T/A145G/K258S/D442E/I491L, M38I/P349R/I491L, A81E/P259D, A81E/T313D/I495L, R92E/P257E/K258Q/A338S/R468T, R92E/K258Q, D94G/Q127E/I132V/A145G/E250D/P349R, D94G/E270D/R301K/P349R/G394E/D442E, D94G/P349R/I491L, A145G/E270D, V178I, E225D,

Q226T, K246R, E250D/P349R/D442E, P259D/T313D/A338S, E270D/P349R, M286T/A338S, M294L, T313D, P349R, P349R/G380R/D442E, F413Y, F413Y/R468I, H448T, and E473D, wherein the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 308 or 1256.

[0174] In some embodiments, the polynucleotide encodes a recombinant amylase comprising a polypeptide sequence having at least 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99%, or more sequence identity to SEQ ID NO: 422 or 1370, or a functional fragment thereof, and wherein the encoded recombinant amylase comprises at least one substitution or substitution set at one or more positions selected from 38, 38/178/226/286/338, 38/178/286/448, 38/178/349/448, 38/226/246/258/286, 38/226/258/286/338/380/448, 38/226/258/349/413, 38/226/286, 38/226/286/338/380, 38/226/338/349/380, 38/226/413/448, 38/246/286, 38/246/286/380, 38/258, 38/286, 38/286/413/448, 38/286/448, 38/448, 178, 178/226/258/286/310/338, 178/226/286/338, 178/246/338, 178/258/286/413, 178/286, 178/286/338/349, 178/286/338/448, 178/380, 178/413, 178/448, 184/246/258/380, 226, 226/246/286/349/448, 226/246/413, 226/258/286/349/380, 226/258/286/413/448, 226/286, 226/286/380/448, 226/349/380, 246, 246/286, 246/286/380/413, 246/338, 246/413, 258/286/413, 286, 286/413/448, 338/448, 349, and 413, wherein the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 422 or 1370. In some embodiments, the encoded recombinant amylase comprises at least one substitution or substitution set selected from 38I, 38I/178I/226T/286T/338S, 38I/178I/286T/448T, 38I/178I/349R/448T, 38I/226T/246R/258S/286T, 38I/226T/258S/286T/338S/380R/448T, 38I/226T/258S/349R/413Y, 38I/226T/286T, 38I/226T/286T/338S/380R, 38I/226T/338S/349R/380R, 38I/226T/413Y/448T, 38I/246R/286T, 38I/246R/286T/380R, 38I/258S, 38I/286T, 38I/286T/413Y/448T, 38I/286T/448T, 38I/448T, 178I, 178I/226T/258S/286T/310R/338S, 178I/226T/286T/338S, 178I/246R/338S, 178I/258S/286T/413Y, 178I/286T, 178I/286T/338S/349R, 178I/286T/338S/448T, 178I/380R, 178I/413Y, 178I/448T, 184K/246R/258S/380R, 226T, 226T/246R/286T/349R/448T, 226T/246R/413Y, 226T/258S/286T/349R/380R, 226T/258S/286T/413Y/448T, 226T/286T, 226T/286T/380R/448T, 226T/349R/380R, 246R, 246R/286T, 246R/286T/380R/413Y, 246R/338S, 246R/413Y, 246T, 258S/286T/413Y, 286T, 286T/413Y/448T, 338S/448T, 349R, and 413Y, wherein the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 422 or 1370. In some embodiments, the encoded recombinant amylase comprises at least one substitution or substitution set selected from M38I, M38I/V178I/Q226T/M286T/A338S, M38I/V178I/M286T/H448T, M38I/V178I/P349R/H448T, M38I/Q226T/K246R/K258S/M286T, M38I/Q226T/K258S/M286T/A338S/G380R/H448T, M38I/Q226T/K258S/P349R/F413Y, M38I/Q226T/M286T, M38I/Q226T/M286T/A338S/G380R, M38I/Q226T/A338S/P349R/G380R, M38I/Q226T/F413Y/H448T, M38I/K246R/M286T, M38I/K246R/M286T/G380R, M38I/K258S,

M38I/M286T, M38I/M286T/F413Y/H448T, M38I/M286T/H448T, M38I/H448T, V178I, V178I/Q226T/K258S/M286T/Q310R/A338S, V178I/Q226T/M286T/A338S, V178I/K246R/A338S, V178I/K258S/M286T/F413Y, V178I/M286T, V178I/M286T/A338S/P349R, V178I/M286T/A338S/H448T, V178I/G380R, V178I/F413Y, V178I/H448T, E184K/K246R/K258S/G380R, Q226T, Q226T/K246R/M286T/P349R/H448T, Q226T/K246R/F413Y, Q226T/K258S/M286T/P349R/G380R, Q226T/K258S/M286T/F413Y/H448T, Q226T/M286T, Q226T/M286T/G380R/H448T, Q226T/P349R/G380R, K246R, K246R/M286T, K246R/M286T/G380R/F413Y, K246R/A338S, K246R/F413Y, K246T, K258S/M286T/F413Y, M286T, M286T/F413Y/H448T, A338S/H448T, P349R, and F413Y, wherein the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 422 or 1370.

[0175] In some embodiments, the polynucleotide encodes a recombinant amylase comprising a polypeptide sequence having at least 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99%, or more sequence identity to SEQ ID NO: 456 or 1404, or a functional fragment thereof, and wherein the encoded recombinant amylase comprises at least one substitution or substitution set at one or more positions selected from 29/31/92/220, 29/469, 49/58/103/141/197/269/294/298, 49/58/103/194/204/298, 49/58/141/298, 49/103, 103, 123, 126, 127, 131, 134, 180, 210, 214, 220/469, 228, 259, 279, 282, 302, 319, 393, 415, 417, 428, 429, 466, and 469, wherein the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 456 or 1404. In some embodiments, the encoded recombinant amylase comprises at least one substitution or substitution set selected from 29E/31L/92A/220G, 29E/469I, 49A/58T/103L/141F/197Y/269F/294H/298Q, 49A/58T/103L/194F/204D/298H, 49A/58T/141F/298H, 49A/103L, 103L, 123R, 126R, 127W, 131H, 131R, 131Y, 134R, 180E, 210P, 214G, 220G/469I, 228V, 259C, 279L, 282T, 302H, 302R, 302W, 319S, 393R, 393S, 415C, 417W, 428T, 429S, 466C, and 469I, wherein the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 456 or 1404. In some embodiments, the encoded recombinant amylase comprises at least one substitution or substitution set selected from R29E/F31L/R92A/A220G, R29E/V469I, S49A/S58T/V103L/Y141F/F197Y/H269F/M294H/E298Q, S49A/S58T/V103L/L194F/N204D/E298H, S49A/S58T/Y141F/E298H, S49A/V103L, V103L, D123R, T126R, Q127W, E131H, E131R, E131Y, E134R, D180E, H210P, E214G, A220G/V469I, Q228V, P259C, D279L, E282T, Q302H, Q302R, Q302W, A319S, E393R, E393S, D415C, P417W, D428T, E429S, Q466C, and V469I, wherein the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 456 or 1404.

[0176] In some embodiments, the polynucleotide encodes a recombinant amylase comprising a polypeptide sequence having at least 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99%, or more sequence identity to SEQ ID NO: 456 or 1404, or a functional fragment thereof, and wherein the encoded recombinant amylase comprises at least one substitution or

substitution set at one or more positions selected from 92, 123, 126, 127, 129, 131, 134, 140, 172, 180, 210, 214, 221, 228, 253, 254, 259, 279, 282, 302, 304, 305, 319, 322, 346, 359, 384, 385, 387, 393, 409, 412, 415, 417, 428, 429, 441, 442, 444, 446, 451, 455, 459, 466, 467, 470, 473, 474, 492, and 494, wherein the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 456 or 1404. In some embodiments, the encoded recombinant amylase comprises at least one substitution or substitution set selected from 92G, 92Q, 123C, 123G, 123R, 126Q, 126R, 127I, 127R, 127S, 127V, 127W, 129C, 129W, 131H, 131R, 131Y, 134A, 134F, 134R, 140V, 172K, 172R, 180E, 180P, 180Q, 210G, 210P, 214G, 214L, 214R, 221T, 221V, 228V, 253R, 254G, 259C, 259R, 259W, 279L, 279V, 282R, 282T, 302G, 302H, 302R, 302V, 302W, 304T, 305Q, 305R, 305W, 319L, 319S, 322R, 346G, 359G, 384M, 385L, 387G, 387V, 393R, 393S, 393W, 409A, 409R, 409W, 412A, 415C, 415G, 417W, 428T, 429S, 441R, 441W, 442R, 442W, 444G, 444R, 444V, 446G, 451F, 455L, 455R, 455T, 455W, 459W, 466C, 467P, 467W, 470G, 470L, 470S, 473M, 474G, 492G, 492R, and 494C, wherein the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 456. In some embodiments, the encoded recombinant amylase comprises at least one substitution or substitution set selected from R92G, R92Q, D123C, D123G, D123R, T126Q, T126R, Q127I, Q127R, Q127S, Q127V, Q127W, D129C, D129W, E131H, E131R, E131Y, E134A, E134F, E134R, R140V, D172K, D172R, D180E, D180P, D180Q, H210G, H210P, E214G, E214L, E214R, R221T, R221V, Q228V, Q253R, E254G, P259C, P259R, P259W, D279L, D279V, E282R, E282T, Q302G, Q302H, Q302R, Q302V, Q302W, R304T, D305Q, D305R, D305W, A319L, A319S, A322R, W346G, E359G, T384M, Y385L, I387G, I387V, E393R, E393S, E393W, V409A, V409R, V409W, D412A, D415C, D415G, P417W, D428T, E429S, D441R, D441W, D442R, D442W, E444G, E444R, E444V, T446G, E451F, N455L, N455R, N455T, N455W, R459W, Q466C, E467P, E467W, V470G, V470L, V470S, E473M, N474G, E492G, E492R, and V494C, wherein the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 456 or 1404.

[0177] In some embodiments, the polynucleotide encodes a recombinant amylase comprising a polypeptide sequence having at least 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99%, or more sequence identity to SEQ ID NO: 546 or 1494, or a functional fragment thereof, and wherein the encoded recombinant amylase comprises at least one substitution or substitution set at one or more positions selected from 123, 123/126/180/214/298/302/393, 123/126/180/214/393/428, 123/126/210/298/302/393, 123/126/210/428, 123/126/428, 123/210/302, 126/180/210/214/298/302, 126/180/210/214/428, 126/180/298/302/393, 126/210/302/428, 126/214/393, 126/298/302/393, 126/298/302/393/428, 129, 129/228/253, 131/228/279, 131/282, 180/214, 210/214/302/393/428, 228/282/444, 253/279/470, 253/279/492, 279, 279/470, and 441, wherein the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 546 or 1494. In some embodiments, the encoded recombinant amylase comprises at least one substitution or substitution set selected from 123R, 123R/126R/180E/214L/298Q/302W/393R,

123R/126R/180Q/214G/393R/428T, 123R/126R/210P/298Q/302W/393R, 123R/126R/210P/428T, 123R/126R/428T, 123R/210P/302R, 126R/180E/210P/214G/428T, 126R/180E/298Q/302R/393R, 126R/180Q/210P/214L/298Q/302R, 126R/210P/302R/428T, 126R/214G/393R, 126R/298Q/302H/393R, 126R/298Q/302R/393R/428T, 129W, 129W/228V/253R, 131H/228V/279V, 131Y/282T, 180Q/214L, 210P/214L/302R/393R/428T, 228V/282T/444R, 253R/279L/492G, 253R/279V/470S, 279L, 279L/470S, and 441R, wherein the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 546 or 1494. In some embodiments, the encoded recombinant amylase comprises at least one substitution or substitution set selected from D123R, D123R/T126R/D180E/E214L/H298Q/Q302W/E393R, D123R/T126R/D180Q/E214G/E393R/D428T, D123R/T126R/H210P/H298Q/Q302W/E393R, D123R/T126R/H210P/D428T, D123R/T126R/D428T, D123R/H210P/Q302R, T126R/D180E/H210P/E214G/D428T, T126R/D180E/H298Q/Q302R/E393R, T126R/D180Q/H210P/E214L/H298Q/Q302R, T126R/H210P/Q302R/D428T, T126R/E214G/E393R, T126R/H298Q/Q302H/E393R, T126R/H298Q/Q302R/E393R/D428T, D129W, D129W/Q228V/Q253R, E131H/Q228V/D279V, E131Y/E282T, D180Q/E214L, H210P/E214L/Q302R/E393R/D428T, Q228V/E282T/E444R, Q253R/D279L/E492G, Q253R/D279V/V470S, D279L, D279L/V470S, and D441R, wherein the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 546 or 1494.

[0178] In some embodiments, the polynucleotide encodes a recombinant amylase comprising a polypeptide sequence having at least 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99%, or more sequence identity to SEQ ID NO: 632 or 1580, or a functional fragment thereof, and wherein the encoded recombinant amylase comprises at least one substitution or substitution set at one or more positions selected from 2, 45/166/298, 48, 48/166/170/203, 52, 58/166, 58/203, 72, 82, 114, 114/223/306/308, 149, 165, 166/203, 167, 170, 184/216/306/308, 184/223/306/437, 189, 203, 225, 255, 258, 275, 280, 284, 294, 298, 396, 397, 411, 431, 448, 468, 482, 483, and 495, wherein the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 632. In some embodiments, the encoded recombinant amylase comprises at least one substitution or substitution set selected from 2L, 45S/166L/298D, 48D, 48D/166L/170S/203S, 52R, 58A/166L, 58A/203S, 72T, 82A, 114R, 114R/223L/306F/308L, 149K, 165V, 166L/203S, 167Y, 170S, 184D/216L/306F/308L, 184D/223L/306F/437L, 189D, 203S, 225T, 255M, 255R, 258S, 275I, 275R, 280C, 284L, 284M, 294A, 298D, 298N, 396E, 396Q, 397M, 411E, 431T, 448P, 468V, 482L, 483A, 495G, and 495L, wherein the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 632 or 1580. In some embodiments, the encoded recombinant amylase comprises at least one substitution or substitution set selected from R2L, Y45S/I166L/H298D, A48D, A48D/I166L/D170S/E203S, Y52R, T58A/I166L, T58A/E203S, S72T, Q82A, H114R, H114R/V223L/Y306F/M308L, Q149K, H165V, I166L/E203S, E167Y, D170S,

E184D/I216L/Y306F/M308L, E184D/V223L/Y306F/M437L, Q189D, E203S, E225T, V255M, V255R, K258S, Q275I, Q275R, Q280C, K284L, K284M, M294A, H298D, H298N, D396E, D396Q, E397M, T411E, P431T, H448P, R468V, N482L, G483A, I495G, and I495L, wherein the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 632 or 1580.

[0179] In some embodiments, the polynucleotide encodes a recombinant amylase comprising a polypeptide sequence having at least 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99%, or more sequence identity to SEQ ID NO: 664 or 1612, or a functional fragment thereof, and wherein the encoded recombinant amylase comprises at least one substitution or substitution set at one or more positions selected from 6/39/103/324/420, 41, 58/500/501, 61, 95/98/205/227/423/458, 95/98/227/423, 95/205, 95/252/285/324, 123/170/197/275/298/396/448/483, 123/197, 123/197/225/294/396/448/469, 123/284/294/324/396/448, 134/225/275/302, 165/225/284/298/469/483, 170/275/294/298/448, 205/206, 205/206/224/315/458/480, 206/227, 206/227/315/423, 225/294/298/396, 227, 392/503, 458, 499, and 500, wherein the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 664 or 1612. In some embodiments, the encoded recombinant amylase comprises at least one substitution or substitution set selected from 6I/39I/103D/324T/420V, 41F, 58S/500P/501P, 61Y, 95L/252I/285V/324T, 95V/98I/205V/227V/423V/458F, 95V/98I/227V/423V, 95V/205V, 123E/170S/197Y/275I/298N/396Q/448Q/483Q, 123E/197Y, 123E/197Y/225G/294A/396Q/448Q/469I, 123E/284L/294A/324T/396Q/448Q, 134R/225G/275I/302W, 165V/225G/284L/298N/469I/483Q, 170S/275I/294A/298N/448Q, 205V/206E, 205V/206E/224L/315S/458F/480L, 206E/227V, 206E/227V/315S/423V, 225G/294A/298N/396Q, 227C, 392C/503L, 458F, 458Y, 499R, and 500P, wherein the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 664 or 1612. In some embodiments, the encoded recombinant amylase comprises at least one substitution or substitution set selected from L6I/V39I/V103D/A324T/I420V, L41F, T58S/H500P/H501P, L61Y, I95L/V252I/T285V/A324T, I95V/L98I/I205V/T227V/S423V/W458F, I95V/L98I/T227V/S423V, I95V/I205V, D123E/D170S/F197Y/Q275I/H298N/D396Q/H448Q/G483Q, D123E/F197Y, D123E/F197Y/E225G/M294A/D396Q/H448Q/V469I, D123E/K284L/M294A/A324T/D396Q/H448Q, E134R/E225G/Q275I/Q302W, H165V/E225G/K284L/H298N/V469I/G483Q, D170S/Q275I/M294A/H298N/H448Q, I205V/D206E, I205V/D206E/M224L/T315S/W458F/F480L, D206E/T227V, D206E/T227V/T315S/S423V, E225G/M294A/H298N/D396Q, T227C, I392C/H503L, W458F, W458Y, G499R, and H500P, wherein the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 664 or 1612.

[0180] In some embodiments, the polynucleotide encodes a recombinant amylase comprising a polypeptide sequence having at least 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%,

95%, 96%, 97%, 98%, 99%, or more sequence identity to SEQ ID NO: 664 or 1612, or a functional fragment thereof, and wherein the encoded recombinant amylase comprises at least one substitution or substitution set at one or more positions selected from 95/252/285/324, 123/197, 123/197/225/294/396/448/469, 134/225/275/302, 205/206, and 205/206/224/315/458/480, wherein the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 664 or 1612. In some embodiments, the encoded recombinant amylase comprises at least one substitution or substitution set selected from 95L/252I/285V/324T, 123E/197Y, 123E/197Y/225G/294A/396Q/448Q/469I, 134R/225G/275I/302W, 205V/206E, and 205V/206E/224L/315S/458F/480L, wherein the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 664 or 1612. In some embodiments, the encoded recombinant amylase comprises at least one substitution or substitution set selected from I95L/V252I/T285V/A324T, D123E/F197Y, D123E/F197Y/E225G/M294A/D396Q/H448Q/V469I, E134R/E225G/Q275I/Q302W, I205V/D206E, and I205V/D206E/M224L/T315S/W458F/F480L, wherein the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 664 or 1612.

[0181] In some embodiments, the polynucleotide encodes a recombinant amylase comprising a polypeptide sequence having at least 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99%, or more sequence identity to SEQ ID NO: 780 or 1728, or a functional fragment thereof, and wherein the encoded recombinant amylase comprises a substitution at position 126, wherein the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 780 or 1728. In some embodiments, the encoded recombinant amylase comprises at least one substitution selected from 126C, 126D, 126E, 126K, 126L, 126M, 126N, 126Q, 126S, 126T, and 126W, wherein the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 780 or 1728. In some embodiments, the encoded recombinant amylase comprises at least one substitution selected from R126C, R126D, R126E, R126K, R126L, R126M, R126N, R126Q, R126S, R126T, and R126W, wherein the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 780 or 1728.

[0182] In some embodiments, the polynucleotides are capable of hybridizing under highly stringent conditions to a reference polynucleotide sequence. In some embodiments, the reference sequence is selected from SEQ ID NOS: 1, 17, 39, 155, 173, 275, 307, 421, 455, 545, 631, 663, 779, 987, 1103, 1121, 1223, 1255, 1369, 1403, 1493, 1579, 1611, and 1727, or a complement thereof, or a polynucleotide sequence encoding any of the variant amylase polypeptides provided herein. In some embodiments, the polynucleotide capable of hybridizing under highly stringent conditions encodes a amylase polypeptide comprising an amino acid sequence that has one or more residue differences as compared to SEQ ID NO: 1, 17, 39, 155, 173, 275, 307, 421, 455, 545, 631, 663, 779, 987, 1103, 1121, 1223, 1255, 1369, 1403, 1493, 1579, 1611, and 1727 at residue positions selected from any

positions as set forth in Table 4-1, 4-2, 4-3, 4-4, 4-5, 4-6, 4-7, 4-8, 4-9, 4-10, 4-11, 4-12, 4-13, and/or 4-14. In some further embodiments, the engineered polynucleotide is selected from those provided in Table 4-1, 4-2, 4-3, 4-4, 4-5, 4-6, 4-7, 4-8, 4-9, 4-10, 4-11, 4-12, 4-13, and/or 4-14, or comprises a polynucleotide having at least 70%, 75%, 80%, 81%, 82%, 83%, 84%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99% or more sequence identity to a reference sequence selected from SEQ ID NO: 1, 17, 39, 155, 173, 275, 307, 421, 455, 545, 631, 663, 779, 987, 1103, 1121, 1223, 1255, 1369, 1403, 1493, 1579, 1611, and 1727. In some additional embodiments, the engineered polynucleotide comprises a sequence having at least 70%, 75%, 80%, 81%, 82%, 83%, 84%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99% or more sequence identity to at least one polynucleotide sequence provided in Table 4-1, 4-2, 4-3, 4-4, 4-5, 4-6, 4-7, 4-8, 4-9, 4-10, 4-11, 4-12, 4-13, and/or 4-14, or at least one polynucleotide sequence provided in Table 4-1, 4-2, 4-3, 4-4, 4-5, 4-6, 4-7, 4-8, 4-9, 4-10, 4-11, 4-12, 4-13, and/or 4-14, wherein the polynucleotide sequence lacks the sequence encoding the histidine tag and the preceding amino acid linker, and/or SEQ ID NO: 1, 17, 39, 155, 173, 275, 307, 421, 455, 545, 631, 663, 779, 987, 1103, 1121, 1223, 1255, 1369, 1403, 1493, 1579, 1611, and 1727. In some further embodiments, the engineered polynucleotide sequence comprises 1-2, 1-3, 1-4, 1-5, 1-6, 1-7, 1-8, 1-9, 1-10, 1-15, 1-20, 1-21, 1-22, 1-23, 1-24, 1-25, 1-30, 1-35, 1-40, 1-45, or 1-50 base changes, as compared to a reference polynucleotide sequence. In still some other embodiments, the engineered polynucleotide sequence comprises 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 30, 31, 32, 33, 34, 35, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, or 50 base changes, as compared to a reference polynucleotide sequence. In some embodiments, the engineered polynucleotide sequence comprises 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 18, 20, 21, 22, 23, 24, or 25 base changes, as compared to a reference polynucleotide sequence.

[0183] In some embodiments, an isolated polynucleotide encoding any of the engineered amylase polypeptides provided herein is manipulated in a variety of ways to provide for expression of the gene and production of the polypeptide. In some embodiments, the polynucleotides encoding the polypeptides are provided as expression vectors, in which one or more control sequences is present to regulate the expression of the polynucleotides and/or polypeptides. Manipulation of the isolated polynucleotide prior to its insertion into a vector may be desirable or necessary depending on the expression vector. The techniques for modifying polynucleotides and nucleic acid sequences utilizing recombinant DNA methods are well known in the art.

[0184] In some embodiments, the control sequences include among other sequences, promoters, leader sequences, polyadenylation sequences, propeptide sequences, signal peptide sequences, and transcription terminators. As known in the art, suitable control sequences can be selected based on the host cells used. It is not intended that the present invention be limited to any specific control sequences.

[0185] Exemplary promoters for bacterial host cells include, but are not limited to promoters obtained from the genes for *Escherichia coli* lactose operon, tryptophan operon, arabinose operon, T7 promoter from the T7 bacteriophage, and *Saccharopolyspora erythraea* erythromycin resistance gene.

[0186] Exemplary promoters for filamentous fungal host cells, include promoters obtained from the genes for *Aspergillus oryzae* TAKA amylase, *Rhizomucor miehei* aspartic proteinase, *Aspergillus niger* neutral alpha-amylase, *Aspergillus niger* acid stable alpha-amylase, *Aspergillus niger* or *Aspergillus awamori* glucoamylase, *Rhizomucor miehei* protease, *Aspergillus oryzae* alkaline protease, *Aspergillus oryzae* triose phosphate isomerase, *Aspergillus nidulans* acetamidase, and *Fusarium oxysporum* trypsin-like protease (See e.g., WO 96/00787), as well as the NA2-tpi promoter (a hybrid of the promoters from the genes for *Aspergillus niger* neutral alpha-amylase and *Aspergillus oryzae* triose phosphate isomerase), and mutant, truncated, and hybrid promoters thereof. Exemplary yeast cell promoters can be from the genes can be from the genes for *Saccharomyces cerevisiae* enolase (ENO-1), *Saccharomyces cerevisiae* galactokinase (GAL1), *Saccharomyces cerevisiae* alcohol dehydrogenase/glyceraldehyde-3-phosphate dehydrogenase (ADH2/GAP), and *Saccharomyces cerevisiae* 3-phosphoglycerate kinase. Other useful promoters for yeast host cells are known in the art (See e.g., Romanos et al., Yeast 8:423-488 [1992]). Exemplary promoters for use in mammalian cells include, but are not limited to those from cytomegalovirus (CMV), Simian vacuolating virus 40 (SV40), from *Homo sapiens* phosphoglycerate kinase, beta actin, elongation factor-1a or glyceraldehyde-3-phosphate dehydrogenase, or from *Gallus gallus'* β-actin.

[0187] In some embodiments, the control sequence is a suitable transcription terminator sequence, a sequence recognized by a host cell to terminate transcription. The terminator sequence is operably linked to the 3' terminus of the nucleic acid sequence encoding the polypeptide. Any terminator which is functional in the host cell of choice finds use in the present invention. For example, exemplary transcription terminators for bacterial host cells can be obtained from the T7 bacterial phage for the T7 terminator, or *Escherichia coli* ribosomal RNA, for example the rrnB terminator. For example, exemplary transcription terminators for filamentous fungal host cells can be obtained from the genes for *Aspergillus oryzae* TAKA amylase, *Aspergillus niger* glucoamylase, *Aspergillus nidulans* anthranilate synthase, *Aspergillus niger* alpha-glucosidase, and *Fusarium oxysporum* trypsin-like protease. Exemplary terminators for yeast host cells can be obtained from the genes for *Saccharomyces cerevisiae* enolase, *Saccharomyces cerevisiae* cytochrome C (CYC1), and *Saccharomyces cerevisiae* glyceraldehyde-3-phosphate dehydrogenase. Other useful terminators for yeast host cells are known in the art (See e.g., Romanos et al., *supra*). Exemplary terminators for mammalian cells include, but are not limited to those from cytomegalovirus (CMV), Simian vacuolating virus 40 (SV40), or from *Homo sapiens* growth hormone.

[0188] In some embodiments, the control sequence is a suitable leader sequence, a non-translated region of an mRNA that is important for translation by the host cell. The leader sequence is operably

linked to the 5' terminus of the nucleic acid sequence encoding the polypeptide. Any leader sequence that is functional in the host cell of choice may be used. Exemplary leaders for filamentous fungal host cells are obtained from the genes for *Aspergillus oryzae* TAKA amylase and *Aspergillus nidulans* triose phosphate isomerase. Suitable leaders for yeast host cells include, but are not limited to those obtained from the genes for *Saccharomyces cerevisiae* enolase (ENO-1), *Saccharomyces cerevisiae* 3-phosphoglycerate kinase, *Saccharomyces cerevisiae* alpha-factor, and *Saccharomyces cerevisiae* alcohol dehydrogenase/glyceraldehyde-3-phosphate dehydrogenase (ADH2/GAP).

[0189] In some embodiments, the control sequence may also be a polyadenylation sequence, a sequence operably linked to the 3' terminus of the nucleic acid sequence and which, when transcribed, is recognized by the host cell as a signal to add polyadenosine residues to transcribed mRNA. Any polyadenylation sequence which is functional in the host cell of choice may be used in the present invention. Exemplary polyadenylation sequences for filamentous fungal host cells include, but are not limited to those from the genes for *Aspergillus oryzae* TAKA amylase, *Aspergillus niger* glucoamylase, *Aspergillus nidulans* anthranilate synthase, *Fusarium oxysporum* trypsin-like protease, and *Aspergillus niger* alpha-glucosidase. Useful polyadenylation sequences for yeast host cells are also known in the art (See e.g., Guo and Sherman, Mol. Cell. Biol., 15:5983-5990 [1995]).

[0190] In some embodiments, the control sequence is a signal peptide coding region that codes for an amino acid sequence linked to the amino terminus of a polypeptide and directs the encoded polypeptide into the cell's secretory pathway. The 5' end of the coding sequence of the nucleic acid sequence may inherently contain a signal peptide coding region naturally linked in translation reading frame with the segment of the coding region that encodes the secreted polypeptide. Alternatively, the 5' end of the coding sequence may contain a signal peptide coding region that is foreign to the coding sequence.

[0191] Any signal peptide coding region that directs the expressed polypeptide into the secretory pathway of a host cell of choice finds use for expression of the engineered amylase polypeptides provided herein. Effective signal peptide coding regions for filamentous fungal host cells include, but are not limited to the signal peptide coding regions obtained from the genes for *Aspergillus oryzae* TAKA amylase, *Aspergillus niger* neutral amylase, *Aspergillus niger* glucoamylase, *Rhizomucor miehei* aspartic proteinase, *Humicola insolens* cellulase, and *Humicola lanuginosa* protease. Useful signal peptides for yeast host cells include, but are not limited to those from the genes for *Saccharomyces cerevisiae* alpha-factor and *Saccharomyces cerevisiae* invertase. Useful signal peptides for mammalian host cells include but are not limited to those from the genes for immunoglobulin gamma (IgG).

[0192] In some embodiments, the control sequence is a propeptide coding region that codes for an amino acid sequence positioned at the amino terminus of a polypeptide. The resultant polypeptide is

referred to as a "proenzyme," "propolypeptide," or "zymogen," in some cases). A propolypeptide can be converted to a mature active polypeptide by catalytic or autocatalytic cleavage of the propeptide from the propolypeptide.

[0193] In another aspect, the present invention also provides a recombinant expression vector comprising a polynucleotide encoding an engineered amylase polypeptide, and one or more expression regulating regions such as a promoter and a terminator, a replication origin, etc., depending on the type of hosts into which they are to be introduced. in some embodiments, the various nucleic acid and control sequences described above are joined together to produce a recombinant expression vector which includes one or more convenient restriction sites to allow for insertion or substitution of the nucleic acid sequence encoding the variant amylase polypeptide at such sites. Alternatively, the polynucleotide sequence(s) of the present invention are expressed by inserting the polynucleotide sequence or a nucleic acid construct comprising the polynucleotide sequence into an appropriate vector for expression. In creating the expression vector, the coding sequence is located in the vector so that the coding sequence is operably linked with the appropriate control sequences for expression.

[0194] The recombinant expression vector may be any vector (e.g., a plasmid or virus), that can be conveniently subjected to recombinant DNA procedures and can result in the expression of the variant amylase polynucleotide sequence. The choice of the vector will typically depend on the compatibility of the vector with the host cell into which the vector is to be introduced. The vectors may be linear or closed circular plasmids.

[0195] In some embodiments, the expression vector is an autonomously replicating vector (i.e., a vector that exists as an extra-chromosomal entity, the replication of which is independent of chromosomal replication, such as a plasmid, an extra-chromosomal element, a minichromosome, or an artificial chromosome). The vector may contain any means for assuring self-replication. In some alternative embodiments, the vector may be one which, when introduced into the host cell, is integrated into the genome and replicated together with the chromosome(s) into which it has been integrated. Furthermore, a single vector or plasmid or two or more vectors or plasmids which together contain the total DNA to be introduced into the genome of the host cell, or a transposon may be used.

[0196] In some embodiments, the expression vector preferably contains one or more selectable markers, which permit easy selection of transformed cells.

[0197] A "selectable marker" is a gene the product of which provides for biocide or viral resistance, resistance to heavy metals, prototrophy to auxotrophs, and the like. Suitable markers for bacterial host cells include, but are not limited to carbenicillin, ampicillin, chloramphenicol, tetracyclineJD, kanamycin and zeocin.

[0198] Suitable markers for yeast host cells include, but are not limited to ADE2, HIS3, LEU2, LYS2, MET3, TRP1, and URA3. Selectable markers for use in a filamentous fungal host cell include, but are not limited to, amdS (acetamidase), argB (ornithine carbamoyltransferases), bar (phosphinothricin acetyltransferase), hph (hygromycin phosphotransferase), niaD (nitrate reductase), pyrG (orotidine-5'-phosphate decarboxylase), sC (sulfate adenyltransferase), and trpC (anthranilate synthase), as well as equivalents thereof. In another aspect, the present invention provides a host cell comprising a polynucleotide encoding at least one engineered amylase polypeptide of the present application, the polynucleotide being operatively linked to one or more control sequences for expression of the engineered amylase enzyme(s) in the host cell.

[0199] Host cells for use in expressing the polypeptides encoded by the expression vectors of the present invention are well known in the art and include but are not limited to, bacterial cells (e.g., *E. coli*); fungal cells, such as yeast cells (e.g., *Saccharomyces cerevisiae* and *Pichia pastoris* [e.g., ATCC Accession No. 201178]); insect cells (e.g., Drosophila S2 and Spodoptera Sf9 cells), plant cells, animal cells (e.g., CHO, COS, and BHK), and human cells (e.g., HEK293T, human fibroblast, THP-1, Jurkat and Bowes melanoma cell lines).

[0200] Accordingly, in another aspect, the present invention provides methods for producing the engineered amylase polypeptides, where the methods comprise culturing a host cell capable of expressing a polynucleotide encoding the engineered amylase polypeptide under conditions suitable for expression of the polypeptide. In some embodiments, the methods further comprise the steps of isolating and/or purifying the amylase polypeptides, as described herein.

[0201] Appropriate culture media and growth conditions for the above-described host cells are well known in the art. Polynucleotides for expression of the amylase may be introduced into cells by various methods known in the art. Techniques include, among others, electroporation, biolistic particle bombardment, liposome mediated transfection, calcium chloride transfection, and protoplast fusion.

[0202] The engineered amylase with the properties disclosed herein can be obtained by subjecting the polynucleotide encoding the naturally occurring or engineered amylase polypeptide to mutagenesis and/or directed evolution methods known in the art, and as described herein. An exemplary directed evolution technique is mutagenesis and/or DNA shuffling (See e.g., Stemmer, Proc. Natl. Acad. Sci. USA 91:10747-10751 [1994]; WO 95/22625; WO 97/0078; WO 97/35966; WO 98/27230; WO 00/42651; WO 01/75767 and U.S. Pat. 6,537,746). Other directed evolution procedures that can be used include, among others, staggered extension process (StEP), in vitro recombination (See e.g., Zhao et al., Nat. Biotechnol., 16:258–261 [1998]), mutagenic PCR (See e.g., Caldwell et al., PCR Methods Appl., 3:S136-S140 [1994]), and cassette mutagenesis (See e.g., Black et al., Proc. Natl. Acad. Sci. USA 93:3525-3529 [1996]).

[0203] Recombinant polypeptides can be produced using any suitable methods known in the art. Genes encoding the wild-type polypeptide of interest can be cloned in vectors, such as plasmids, and expressed in desired hosts, such as *E. coli,* etc. Variants of recombinant polypeptides can be generated by various methods known in the art. Indeed, there is a wide variety of different mutagenesis techniques well known to those skilled in the art. In addition, mutagenesis kits are also available from many commercial molecular biology suppliers. Methods are available to make specific substitutions at defined amino acids (site-directed), specific or random mutations in a localized region of the gene (regio-specific), or random mutagenesis over the entire gene (e.g., saturation mutagenesis). Numerous suitable methods are known to those in the art to generate enzyme variants, including but not limited to site-directed mutagenesis of single-stranded DNA or double-stranded DNA using PCR, cassette mutagenesis, gene synthesis, error-prone PCR, shuffling, and chemical saturation mutagenesis, or any other suitable method known in the art. Mutagenesis and directed evolution methods can be readily applied to enzyme-encoding polynucleotides to generate variant libraries that can be expressed, screened, and assayed. Any suitable mutagenesis and directed evolution methods find use in the present invention and are well known in the art (See e.g., US Patent Nos. 5,605,793, 5,811,238, 5,830,721, 5,834,252, 5,837,458, 5,928,905, 6,096,548, 6,117,679, 6,132,970, 6,165,793, 6,180,406, 6,251,674, 6,265,201, 6,277,638, 6,287,861, 6,287,862, 6,291,242, 6,297,053, 6,303,344, 6,309,883, 6,319,713, 6,319,714, 6,323,030, 6,326,204, 6,335,160, 6,335,198, 6,344,356, 6,352,859, 6,355,484, 6,358,740, 6,358,742, 6,365,377, 6,365,408, 6,368,861, 6,372,497, 6,337,186, 6,376,246, 6,379,964, 6,387,702, 6,391,552, 6,391,640, 6,395,547, 6,406,855, 6,406,910, 6,413,745, 6,413,774, 6,420,175, 6,423,542, 6,426,224, 6,436,675, 6,444,468, 6,455,253, 6,479,652, 6,482,647, 6,483,011, 6,484,105, 6,489,146, 6,500,617, 6,500,639, 6,506,602, 6,506,603, 6,518,065, 6,519,065, 6,521,453, 6,528,311, 6,537,746, 6,573,098, 6,576,467, 6,579,678, 6,586,182, 6,602,986, 6,605,430, 6,613,514, 6,653,072, 6,686,515, 6,703,240, 6,716,631, 6,825,001, 6,902,922, 6,917,882, 6,946,296, 6,961,664, 6,995,017, 7,024,312, 7,058,515, 7,105,297, 7,148,054, 7,220,566, 7,288,375, 7,384,387, 7,421,347, 7,430,477, 7,462,469, 7,534,564, 7,620,500, 7,620,502, 7,629,170, 7,702,464, 7,747,391, 7,747,393, 7,751,986, 7,776,598, 7,783,428, 7,795,030, 7,853,410, 7,868,138, 7,783,428, 7,873,477, 7,873,499, 7,904,249, 7,957,912, 7,981,614, 8,014,961, 8,029,988, 8,048,674, 8,058,001, 8,076,138, 8,108,150, 8,170,806, 8,224,580, 8,377,681, 8,383,346, 8,457,903, 8,504,498, 8,589,085, 8,762,066, 8,768,871, 8,849,575, 9,593,326, 9,665,694, 9,684,771, 9,864,833, 9,996,661, and all related US, as well as PCT and non-US counterparts; Ling et al., Anal. Biochem., 254(2):157-78 [1997]; Dale et al., Meth. Mol. Biol., 57:369-74 [1996]; Smith, Ann. Rev. Genet., 19:423-462 [1985]; Botstein et al., Science, 229:1193-1201 [1985]; Carter, Biochem. J., 237:1-7 [1986]; Kramer et al., Cell, 38:879-887 [1984]; Wells et al., Gene, 34:315-323 [1985]; Minshull et al., Curr. Op. Chem. Biol., 3:284-290 [1999]; Christians et al., Nat. Biotechnol., 17:259-264 [1999]; Crameri et al., Nature, 391:288-291 [1998]; Crameri, et al., Nat. Biotechnol., 15:436-438 [1997]; Zhang et al., Proc. Nat. Acad. Sci. U.S.A., 94:4504-4509 [1997]; Crameri et al., Nat. Biotechnol., 14:315-319 [1996];

Stemmer, Nature, 370:389-391 [1994]; Stemmer, Proc. Nat. Acad. Sci. USA, 91:10747-10751 [1994]; WO 95/22625; WO 97/0078; WO 97/35966; WO 98/27230; WO 00/42651; WO 01/75767; and WO 2009/152336, all of which are incorporated herein by reference).

[0204] In some embodiments, the enzyme variants obtained following mutagenesis treatment are screened by subjecting the enzyme variants to a defined temperature (or other assay conditions) and measuring the amount of enzyme activity remaining after heat treatments or other assay conditions. DNA containing the polynucleotide encoding the amylase polypeptide is then isolated from the host cell, sequenced to identify the nucleotide sequence changes (if any), and used to express the enzyme in a different or the same host cell. Measuring enzyme activity from the expression libraries can be performed using any suitable method known in the art (e.g., standard biochemistry techniques, such as HPLC analysis).

[0205] For engineered polypeptides of known sequence, the polynucleotides encoding the enzyme can be prepared by standard solid-phase methods, according to known synthetic methods. In some embodiments, fragments of up to about 100 bases can be individually synthesized, then joined (e.g., by enzymatic or chemical ligation methods, or polymerase mediated methods) to form any desired continuous sequence. For example, polynucleotides and oligonucleotides disclosed herein can be prepared by chemical synthesis using the classical phosphoramidite method (See e.g., Beaucage et al., Tetra. Lett., 1981, 22:1859-69; and Matthes et al., EMBO J., 1984, 3:801-05), as it is typically practiced in automated synthetic methods. According to the phosphoramidite method, oligonucleotides are synthesized (e.g., in an automatic DNA synthesizer), purified, annealed, ligated and cloned in appropriate vectors. However, it is not intended that the present invention be limited to any specific method for production of polynucleotides and oligonucleotides, as any suitable method finds use in the present invention.

[0206] Accordingly, in some embodiments, a method for preparing the engineered amylase polypeptide can comprise: (a) synthesizing a polynucleotide encoding a polypeptide comprising an amino acid sequence selected from the amino acid sequence of any variant provided in Table 4-1, 4-2, 4-3, 4-4, 4-5, 4-6, 4-7, 4-8, 4-9, 4-10, 4-11, 4-12, 4-13, and/or 4-14; any variant provided in Table 4-1, 4-2, 4-3, 4-4, 4-5, 4-6, 4-7, 4-8, 4-9, 4-10, 4-11, 4-12, 4-13, and/or 4-14, wherein the variant lacks the histidine tag and preceding amino acid linker; as well as SEQ ID NOS: 2, 18, 40, 156, 174, 276, 308, 422, 456, 546, 632, 664, 780, 988, 1104, 1122, 1224, 1256, 1370, 1404, 1494, 1580, 1612, and/or 1728; any of the even numbered polypeptide sequence of SEQ ID NOS: 4-18, 22-966, and 970-1914; and (b) expressing the amylase polypeptide encoded by the polynucleotide. In some embodiments of the method, the amino acid sequence encoded by the polynucleotide comprises one or several (e.g., up to 3, 4, 5, or up to 10) amino acid residue deletions, insertions and/or substitutions. In some further embodiments, the amino acid sequence comprises 1-2, 1-3, 1-4, 1-5, 1-6, 1-7, 1-8, 1-9, 1-10, 1-15, 1-20, 1-21, 1-22, 1-23, 1-24, 1-25, 1-30, 1-35, 1-40, 1-45, or 1-50 amino acid residue deletions,

insertions and/or substitutions. In still some other embodiments, the amino acid sequence comprises 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 30, 31, 32, 33, 34, 35, 40, 45, or 50 amino acid residue deletions, insertions and/or substitutions. In some embodiments, the amino acid sequence comprises 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 18, 20, 21, 22, 23, 24, or 25 amino acid residue deletions, insertions and/or substitutions. In some embodiments, the substitutions are conservative or non-conservative substitutions.

[0207] The expressed engineered amylase polypeptide can be assessed for any desired improved property (e.g., activity, selectivity, stability, acid tolerance, protease sensitivity, etc.), using any suitable assay known in the art, including but not limited to the assays and conditions described herein.

[0208] In some embodiments, any of the engineered amylase polypeptides expressed in a host cell are recovered from the cells and/or the culture medium using any one or more of the well-known techniques for protein purification, including, among others, lysozyme treatment, sonication, filtration, salting-out, heat treatment, ultra-centrifugation, and chromatography.

[0209] Chromatographic techniques for isolation of the amylase polypeptides include, among others, reverse phase chromatography high performance liquid chromatography, ion exchange chromatography, hydrophobic interaction chromatography, gel electrophoresis, and affinity chromatography. Conditions for purifying a particular enzyme depends, in part, on factors such as net charge, hydrophobicity, hydrophilicity, molecular weight, molecular shape, etc., and will be apparent to those having skill in the art. In some embodiments, affinity techniques may be used to isolate the improved variant amylase enzymes. In some embodiments utilizing affinity chromatography purification, any antibody which specifically binds the variant amylase polypeptide finds use.

[0210] In some embodiments utilizing affinity chromatography purification, proteins that bind to the glycans covalently attached to amylase find use. In still other embodiments utilizing affinity-chromatography purifications, any small molecule that binds to the amylase active site finds use. For the production of antibodies, various host animals, including but not limited to rabbits, mice, rats, etc., are immunized by injection with a polypeptide (e.g., a amylase variant), or a fragment thereof. In some embodiments, the amylase polypeptide or fragment is attached to a suitable carrier, such as BSA, by means of a side chain functional group or linkers attached to a side chain functional group.

[0211] In some embodiments, the engineered amylase polypeptide is produced in a host cell by a method comprising culturing a host cell (e.g., *E. coli*, *S. cerevisiae*, *Daucus carota*, *Nicotiana tabacum*, *H. sapiens* (e.g., HEK293T), or *Cricetulus griseus* (e.g., CHO)) comprising a polynucleotide sequence encoding an engineered amylase polypeptide as described herein under conditions conducive to the production of the engineered amylase polypeptide and recovering the engineered amylase polypeptide from the cells and/or culture medium.

[0212] In some embodiments, the invention encompasses a method of producing an engineered amylase polypeptide comprising culturing a recombinant eukaryotic cell comprising a polynucleotide sequence encoding an engineered amylase polypeptide having at least 80%, 81%, 82%, 83%, 84%, 85%, 86%, 87%, 88%, 89%, 90%, 95%, 96%, 97%, 98%, 99%, or 100% sequence identity to a reference sequence (e.g., SEQ ID NO: 2, 18, 40, 156, 174, 276, 308, 422, 456, 546, 632, 664, 780, 988, 1104, 1122, 1224, 1256, 1370, 1404, 1494, 1580, 1612, and/or 1728), and one or more amino acid residue differences as compared to SEQ ID NO: 2, 18, 40, 156, 174, 276, 308, 422, 456, 546, 632, 664, 780, 988, 1104, 1122, 1224, 1256, 1370, 1404, 1494, 1580, 1612, and/or 1728, selected from those provided in Table 4-1, 4-2, 4-3, 4-4, 4-5, 4-6, 4-7, 4-8, 4-9, 4-10, 4-11, 4-12, 4-13, and/or 4-14, and/or combinations thereof when optimally aligned with the amino acid sequence of SEQ ID NO: 2, 18, 40, 156, 174, 276, 308, 422, 456, 546, 632, 664, 780, 988, 1104, 1122, 1224, 1256, 1370, 1404, 1494, 1580, 1612, and/or 1728, under suitable culture conditions to allow the production of the engineered amylase polypeptide and optionally recovering the engineered amylase polypeptide from the culture and/or cultured bacterial cells.

[0213] In some embodiments, once the engineered polypeptides are recovered from the recombinant host cells or cell culture medium, they are further purified by any suitable method(s) known in the art. In some additional embodiments, the purified amylase polypeptides are combined with other ingredients and compounds to provide compositions and formulations comprising the engineered amylase polypeptide as appropriate for different applications and uses (e.g., pharmaceutical compositions). In some additional embodiments, the purified polypeptides, or the formulated amylase polypeptides are lyophilized.

Compositions

[0214] The present invention provides various compositions and formats, including but not limited to those described below. In some embodiments, the present invention provides engineered amylase polypeptides suitable for use in pharmaceutical and other compositions, such as dietary and/or nutritional supplements.

[0215] Depending on the mode of administration, these compositions comprising a therapeutically effective amount of an engineered amylase according to the invention are in the form of a solid, semi-solid, or liquid. In some embodiments, the compositions include other pharmaceutically acceptable components such as diluents, buffers, excipients, salts, emulsifiers, preservatives, stabilizers, fillers, and other ingredients. Details on techniques for formulation and administration are well known in the art and described in the literature.

[0216] In some embodiments, the engineered amylase polypeptides are formulated for use in pharmaceutical compositions. Any suitable format for use in delivering the engineered amylase polypeptides find use in the present invention, including but not limited to pills, tablets, gel tabs,

capsules, lozenges, dragees, powders, soft gels, sol-gels, gels, emulsions, implants, patches, sprays, ointments, liniments, creams, pastes, jellies, paints, aerosols, chewing gums, demulcents, sticks, solutions, suspensions (including but not limited to oil-based suspensions, oil-in water emulsions, etc.), slurries, syrups, controlled release formulations, suppositories, etc. In some embodiments, the engineered amylase polypeptides are provided in a format suitable for injection or infusion (i.e., in an injectable formulation). In some embodiments, the engineered amylase polypeptides are provided in biocompatible matrices such as sol-gels, including silica-based (e.g., oxysilane) sol-gels. In some embodiments, the engineered amylase polypeptides are encapsulated and/or enterically coated. In some alternative embodiments, the engineered amylase polypeptides are encapsulated in nanostructures (e.g., nanotubes, nanotubules, nanocapsules, or microcapsules, microspheres, liposomes, etc.). Indeed, it is not intended that the present invention be limited to any particular delivery formulation and/or means of delivery. It is intended that the engineered amylase polypeptides be administered by any suitable means known in the art, including but not limited to parenteral, oral, topical, transdermal, intranasal, intraocular, intrathecal, via implants, etc.

[0217] In some embodiments, the engineered amylase polypeptides are chemically modified by glycosylation, chemical crosslinking reagents, pegylation (i.e., modified with polyethylene glycol [PEG] or activated PEG, etc.) or other compounds (See e.g., Ikeda, Amino Acids, 2005, 29:283-287; US Pat. Nos. 7,531,341, 7,534,595, 7,560,263, and 7,553,653; US Pat. Appln. Publ. Nos. 2013/0039898, 2012/0177722, etc.). Indeed, it is not intended that the present invention be limited to any particular delivery method and/or mechanism.

[0218] In some additional embodiments, the engineered amylase polypeptides are provided in formulations comprising matrix-stabilized enzyme crystals. In some embodiments, the formulation comprises a cross-linked crystalline engineered amylase enzyme and a polymer with a reactive moiety that adheres to the enzyme crystals. The present invention also provides engineered amylase polypeptides in polymers.

[0219] In some embodiments, compositions comprising the engineered amylase polypeptides of the present invention include one or more commonly used carrier compounds, including but not limited to sugars (e.g., lactose, sucrose, mannitol, and/or sorbitol), starches (e.g., corn, wheat, rice, potato, or other plant starch), cellulose (e.g., methyl cellulose, hydroxypropylmethyl cellulose, sodium carboxy-methylcellulose), gums (e.g., arabic, tragacanth, guar, etc.), and/or proteins (e.g., gelatin, collagen, etc.).

[0220] In some embodiments, the engineered amylase polypeptide is suitable for use to improve dietary starch digestion. In some further embodiments, the engineered amylase polypeptide finds use in breaking down starch in food and feed, prior to the consumption of the food or feed. The dosage of engineered amylase polypeptide(s) administered depends upon the condition or disease, the general

condition of the subject, and other factors known to those in the art. In some embodiments, the compositions are intended for single or multiple administrations. In some embodiments, it is contemplated that the concentration of engineered amylase polypeptide(s) in the composition(s) administered to a human with pancreatic insufficiency disease is sufficient to effectively treat, and/or ameliorate disease (e.g., pancreatic insufficiency disease). In some embodiments, one or more of the engineered amylase polypeptide(s) of the present disclosure, for example formulated in as composition(s), is administered to a human with pancreatic insufficiency disease in an amount sufficient to effectively treat, and/or ameliorate disease pancreatic insufficiency disease. In some embodiments, the engineered amylase polypeptides are administered in combination with other pharmaceutical and/or dietary compositions. In some embodiments, the engineered amylase polypeptides find use in combination with other enzymes, such as lipases and/or proteases, for the treatment of diseases such as pancreatic enzyme insufficiency. In some embodiments, the subject is for treatment is a non-human mammal, such as, but not limited to, a non-human primate, pigs, cows, dogs, and cats.

[0221] In some embodiments, the engineered lipase polypeptides are administered in combination with other pharmaceutical and/or dietary compositions, including but not limited to dietary supplements, nutraceuticals, etc. It is not intended that the present invention be limited to any specific method or form of administration, as any suitable method and/or form finds use.

EXAMPLES

[0222] The following Examples, including experiments and results achieved, are provided for illustrative purposes only and are not to be construed as limiting the present invention. In the experimental disclosure below, the following abbreviations apply: ppm (parts per million); M (molar); mM (millimolar), uM and μM (micromolar); nM (nanomolar); mol (moles); gm and g (gram); mg (milligrams); ug and μg (micrograms); L and l (liter); ml and mL (milliliter); cm (centimeters); mm (millimeters); um and μm (micrometers); sec. (seconds); min(s) (minute(s)); h(s) and hr(s) (hour(s)); kDa (kilodaltons); U (units); MW (molecular weight); rpm (rotations per minute); °C (degrees Centigrade); CDS (coding sequence); DNA (deoxyribonucleic acid); RNA (ribonucleic acid); *E. coli* W3110 (commonly used laboratory *E. coli* strain, available from the Coli Genetic Stock Center [CGSC], New Haven, CT); EPI (exocrine pancreatic insufficiency); ethylidene-pNP-G7 (ethylidene-4-nitrophenyl-alpha-D-maltoheptaoside); btLIP (*B. thermoamylovorans* lipase); HPLC (high pressure liquid chromatography); ms (mass spectrometry or mass spectroscopy); SDS-PAGE (sodium dodecyl sulfate polyacrylamide gel electrophoresis); PBS (phosphate buffered saline); PES (polyethersulfone); ACN (acetonitrile); DNSA (dinitrosalicylic acid); IPA (isopropyl alcohol); IPTG (isopropyl β-D-1-thiogalactopyranoside); PMBS (polymyxin B sulfate); NADPH (nicotinamide adenine dinucleotide phosphate); LB (Luria broth); MeOH (methanol); FIOPC and FIOP (fold improvements over positive control); HTP (high throughput); CAV (cell accelerator voltage; collision cell accelerator voltage); CE

(collision energy); RF (radio frequency); NEB (New England Biolabs, Inc., Ipswich, MA); Biorad (Bio-Rad Laboratories, Inc., Hercules, CA); Greiner (Greiner Bio-One North America, Inc., Monroe, NC); GE Healthcare (GE Healthcare, Chicago, IL); Sigma-Aldrich (Sigma-Aldrich, St. Louis, MO); Pall Corp. (Pall, Corp., Pt. Washington, NY); Millipore (Millipore, Corp., Billerica MA); Difco (Difco Laboratories, BD Diagnostic Systems, Detroit, MI); Molecular Devices (Molecular Devices, LLC, Sunnyvale, CA); Kuhner (Adolf Kuhner, AG, Basel, Switzerland); Applied Biosystems (Applied Biosystems, part of Life Technologies, Corp., Grand Island, NY), Agilent (Agilent Technologies, Inc., Santa Clara, CA); RAPIDFIRE® MS (RAPIDFIRE® mass spectrometer, Agilent); Thermo Scientific (part of ThermoFisher Scientific, Waltham, MA); Gibco (ThermoFisher Scientific); Pierce (Pierce Biotechnology (now part of Thermo Fisher Scientific), Rockford, IL); ThermoFisher Scientific (Thermo Fisher Scientific, Waltham, MA); Corning (Corning, Inc., Palo Alto, CA); and Bio-Rad (Bio-Rad Laboratories, Hercules, CA).

EXAMPLE 1 - Amylase Gene Acquisition and Construction of Expression Vectors

[0223] The DNA sequences encoding bacterial amylases from various organisms listed in **Table 1-1**, were codon-optimized for expression in *E. coli*, and cloned into the *E. coli* expression vector pCK110900 vector system (See e.g., US Pat. Nos. 7,629,157, and 9,714,437, and US Pat. Appln. Publn. 2006/0195947, all of which are hereby incorporated by reference herein). The plasmid construct was transformed into an *E. coli* strain derived from W3110. The *E. coli* strains containing the amylase genes were grown in either 96-well or shake flask format and assayed for amylase activity as described in Example 3. The activity obtained from these amylases are shown in **Table 1-1**.

Table 1-1. Amylase Activity of Alpha-Amylases from Various Organisms[1]

SEQ ID NO: (nt/aa)	Accession No.	Organism	Activity (A405)
1/2	P26612	*Escherichia coli*	+++
3/4	CAA44638.1	*Alicyclobacillus acidocaldarius*	+
5/6	AAF00567.1	*Cytophaga* sp.	+++
7/8	P26613	*Salmonella typhimurium*	+++
9/10	ADD77452.1	*Pantoea ananatis*	+
11/12	WP_004392868.1	*Yersinia kristensenii*	+++
13/14	WP_017372073.1	Enterobacteriaceae bacterium LSJC7	+
15/16	WP_059351662.1	*Bacillus coahuilensis*	++

Table 1-1. Amylase Activity of Alpha-Amylases from Various Organisms[1]			
SEQ ID NO: (nt/aa)	**Accession No.**	**Organism**	**Activity (A405)**
[1]Levels of activity are expressed as absorbance units at 405nm and defined as follows: "+" > 0.004; "++" > 0.04; and "+++" > 0.4.			

EXAMPLE 2 - Engineered Amylase Variants Expression and Construction

[0224] Based on the results shown in Table 1-1, the amylase from SEQ ID NO: 2 was subcloned with a C-terminal 6xHis-tag into the pJV110900 vector system (See e.g., US Pat. Appln Publ. 2017/213758, hereby incorporated by reference) to generate SEQ ID NO: 18. However, it is not intended that the present invention be limited to any specific vectors. The plasmid construct was transformed into an *E. coli* strain derived from W3110. Directed evolution techniques generally known by those skilled in the art were used to generate libraries of gene variants from this plasmid construct (See e.g., US Pat. No. 8,383,346, and WO2010/144103) as well as its derivatives.

EXAMPLE 3 - High-Throughput (HTP) Growth of Amylase Variants and Screening Conditions

[0225] Methods used to grow cells producing the amylases of the present invention, as well as screening methods to characterize the amylases are provided in this Example.

High-Throughput (HTP) Growth of *E. coli* Amylase and Variant Amylases

[0226] Transformed *E. coli* cells were selected by plating onto LB agar plates containing 1% glucose with selection. After overnight incubation at 37°C, colonies were placed into the wells of 96-well shallow flat bottom plates (NUNC™, Thermo-Scientific) filled with 180 µl/well LB supplemented with 1% glucose and a selection marker. The cultures were allowed to grow overnight for 18-20 hours in a shaker incubator (200 rpm, 30°C, and 85% relative humidity; Kuhner).

[0227] Overnight growth samples (20 µL) were transferred into COSTAR® 96-well deep plates filled with 380µL of Terrific Broth supplemented with a selection compound (e.g., chloramphenicol). The plates were incubated for 135 minutes in a shaker incubator (250 rpm, 30°C, and 85% relative humidity; Kuhner). The expression of the amylase variants was then induced with 40 µL of 10 mM IPTG in sterile water and the cultures were incubated overnight for 20-24 hours in a shaker incubator (250 rpm, 30°C, and 85% relative humidity; Kuhner). The cells were pelleted by centrifugation (4000 rpm x 20 min), the supernatants were discarded, and the cells were frozen at -80°C prior to analysis.

Lysis of HTP Pellets

[0228] First, 200-400 µL of lysis buffer (1X PBS, 1 mg/ml lysozyme, 0.5 mg/ml polymyxin B sulfate, and .1U/mL DNAse I (NEB) were added to the cell pellets. The cell pellet and buffer were gently shaken for 1.5-2 hours at room temperature, and centrifuged (4000 rpm x 15 min) prior to use of the clarified lysates in the various HTP assays described herein. Analysis of these lysates by SDS-PAGE revealed the presence of an overexpressed protein bands at an apparent MW of 57kDa,

consistent with the expected MW of the amylase of interest. In some additional experiments, additional dilutions of clarified lysate were performed with PBS buffer prior to challenges and analysis.

Analysis of Clarified Lysates or Purified Protein for Amylase Activity

[0229] Amylase activity was assessed using soluble starch as a substrate and quantifying maltose produced from starch hydrolysis using dinitrosalicylic acid (DNSA). Starch solution was prepared by mixing 10 mg/mL potato starch in assay buffer (20 mM sodium phosphate buffer pH 6.9 + 6.7 mM NaCl, or 100 mM $NaPO_4$ pH, 6.0 – 7.0). To dissolve the starch, the solution was heated on a stir plate to near boiling then allowed to cool to room temperature. To create the DNSA solution, 20 ml of 96 mM DNSA in water was added dropwise to 12 ml water and 8 ml 5.3M potassium sodium tartrate tetrahydrate in 2N NaOH with mixing on a hot plate (70-80°C); DNSA solution was cooled to room temperature before use. To set up amylase activity reactions, starch substrate solution was mixed 2:1 with diluted enzyme in a PCR plate (BioRad) and incubated at 37 °C for 30 minutes. The reaction was then mixed 1:1 with the DNSA solution and incubated for 15 minutes at 95 °C in a thermocycler. Samples were diluted 2x in assay buffer and transferred to a UV-STAR® flat bottom plate (Greiner), then read for absorbance at 540nm on a Molecular Devices SPECTRAMAX® M2 plate reader. In some experiments, in order to ensure that samples did not saturate the assay, samples were diluted in PBS buffer prior to analysis, based on a pre-determined dilution factor (up to 512x).

Alternate Method for Analysis of Clarified Lysates or Purified Protein for Amylase Activity

[0230] In some experiments, amylase activity was assessed by using ethylidene pNP-G7 as a substrate and monitoring the p-nitrophenol released by monitoring absorbance at A405. This assay was performed using an Amylase Activity Assay Kit (Sigma). In this assay, 50 ul of challenged, diluted amylase variant were added to 50 ul of provided assay buffer and 50 ul of provided ethylidene pNP-G7 substrate solution. Absorbance at 405nm was monitored for 15 minutes, and absorbance at a representative time point was used for subsequent analysis.

HTP Analysis of Clarified Lysates or Purified Proteins Pre-Treated with Heat Challenge

[0231] To assess the thermostability of the variants, clarified lysate was transferred to a PCR plate (Biorad) and incubated for 1 hr at 40-60°C in a thermocycler. After incubation, samples were centrifuged to pellet heat-precipitated proteins and the supernatant was analyzed for amylase residual activity as described herein.

HTP Analysis of Clarified Lysates or Purified Proteins Pre-Treated with low pH and Pepsin

[0232] The activities of amylase variants were determined after pre-incubation at low pH in the presence of pepsin, to simulate the stomach environment. First, clarified lysate was diluted 0x – 32x in PBS buffer, then mixed 1:1 with McIlvaine buffer, pH 2.3-3.5 + 3.0 mg/mL pepsin from porcine

gastric mucosa (Sigma) in a PCR plate (Biorad), for a final challenge pH of 2.3-3.5 and a final pepsin concentration of 1.5 mg/ml. Samples were mixed and then incubated for 1-2 hrs at 37°C. To stop the challenges, samples were mixed 1:1 with 400 mM $NaPO_4$, pH 7.0, to neutralize the pH and inactivate the pepsin. Neutralized challenge samples were then analyzed for residual amylase activity as described herein.

HTP Evaluation of Amylase Activity After Incubation with Intestinal Proteases

[0233] The activities of variants were determined after pre-incubation at neutral pH in the presence of sodium taurocholate and intestinal proteases, to simulate the intestinal environment. Clarified lysate was mixed 1:1 in a PCR plate (BioRad) with 100 mM $NaPO_4$, pH 7.0, or PBS containing 0-10 mM sodium taurocholate, trypsin from porcine pancreas at 3mg/ml, and chymotrypsin from bovine pancreas at 3 mg/ml, for a final concentration of 0-5 mM sodium taurocholate, and a final concentration of 1.5 mg/ml of each challenging intestinal protease. The mixture was incubated for 1-2 hrs at 37°C, in a thermocycler. Samples were then analyzed for residual amylase activity as described herein.

HTP Evaluation of Amylase Activity After Incubation with Engineered Protease

[0234] The activities of amylase variants were determined after pre-incubation at neutral pH in the presence of an engineered trypsin-like protease (SEQ ID NO: 20). Clarified lysate was mixed 1:1 in a PCR plate (BioRad) with PBS containing 3 mg/ml lyophilized powder of SEQ ID NO: 20, for a final concentration of 1.5 mg/ml protease in the challenge. The mixture was incubated for 1-2 hrs at 37°C, in a thermocycler. Samples were then analyzed for residual amylase activity as described herein.

HTP Evaluation of Amylase Activity After Multiple Sequential Challenges

[0235] When two stability characteristics were simultaneously being investigated, multiple challenge screens were combined in series. For example, in some experiments, a one hour heat challenge was followed by a one hour pH and pepsin challenge, which was then followed by a one hour intestinal challenge. In the instance of an intestinal challenge following a gastric challenge, the challenging intestinal proteases were dissolved in the neutralization buffer for the gastric challenge, so that the intestinal challenge was started immediately upon neutralization of the gastric challenge. This is denoted as a "sequential challenge." Following a sequential challenge, samples were analyzed for residual amylase activity as described herein.

Shake Flask Expression, Purification and Characterization of Amylase Variants

[0236] A single colony of *E. coli* containing a plasmid encoding an engineered amylase was inoculated into 5 mL Luria Bertani media with 1% glucose and a selection marker. Cells were grown overnight (at least 16 hours) in an incubator at 30°C with shaking at 250 rpm. The culture was diluted into 250 mL Terrific Broth (12 g/L bacto-tryptone, 24 g/L yeast extract, 4 mL/L glycerol, 65 mM

potassium phosphate, pH 7, 1 mM $MgSO_4$) with selection, in a 1 liter flask and allowed to grow at 30°C. Expression of the amylase gene was induced by addition of IPTG to a final concentration of 1 mM when the OD600 of the culture reached 0.6 to 0.8. Incubation was then continued overnight (at least 16 hours). Cells were harvested by centrifugation (5000 rpm, 15 min, 4°C) and the supernatant discarded. The cells were resuspended in 40-50 ml of PBS with 150 mM NaCl, and passed through a MICROFLUDIZER® high pressure homogenizer (Microfluidics) with standard *E. coli* lysis settings and maintained at 4°C.

[0237] The cleared lysate supernatant was collected, and imidazole was added to the lysate for a final concentration of 25 mM. This lysate was HIS-affinity purified on the AKTA Start system with the AC Step 1 ml/5 ml HiTrap - Affinity Chromatography Quick Start using the manufacturer's (GE Healthcare) protocol, using PBS with150mL NaCl and 25 mM imidazole as the wash buffer, and PBS with 150 ml NaCl and 250 mM imidazole as the elution buffer. The purified amylase variants were buffer exchanged into PBS with ECONOPAC®-10DG desalting prepacked gravity-flow columns (Biorad).

[0238] The purified amylase variants were assayed for unchallenged activity, gastric stability, intestinal stability in a similar manner as described herein, except that instead of using cell lysates, 1 mg/ml of the purified enzymes were used in the stability experiments.

EXAMPLE 4: Screening Results For Amylase Variants

[0239] Library variants were generated from homolog diversity and saturation mutagenesis on surface positions based on a structural model of SEQ ID NO: 18. These variants were screened in triplicate for amylase activity at pH 6.8, after the sequential challenge of 1 hour incubation at 50°C, followed by a 1 hour gastric challenge (1.5 mg/mL pepsin, pH 3), and finally a 1 hour intestinal challenge for 1 hour, as described in Example 3. The results (relative to the results for SEQ ID NO: 18) are provided in **Table 4-1**.

Table 4-1. Amylase Activity (Relative to SEQ ID NO: 18)[1]

SEQ ID NO: (nt/aa)	Amino Acid Differences (Relative to SEQ ID NO: 18)	Amylase Activity Post Sequential Challenge (Relative to SEQ ID NO: 18)
21/22	K158R	++++
23/24	D396H/L412D	++++
25/26	K284S	++++
27/28	E26A/R27L/L412D	++++
29/30	D272G	+++
31/32	P74A/Y371F/H374S/Q383E/E493D	+++

Table 4-1. Amylase Activity (Relative to SEQ ID NO: 18)[1]		
33/34	E26A/R27L/Q466E/E473D	+++
35/36	V317G/Q383L	+++
37/38	D396H/L412D/D428E/Q466E	+++
39/40	E16D/D33E/F157Y/A256S/M302Q/Y371F/Q383E	+++
41/42	P257G	+++
43/44	D388E/D396H/L412D/D428E	+++
45/46	E26A/R27L/D396H/L412D/D428E/E473D	+++
47/48	Q149R	+++
49/50	A256S/Q383E	+++
51/52	E130D/A256S/E493D	+++
53/54	P257E	+++
55/56	E16D/A256S/M302Q/H374S	+++
57/58	I73V/E130D/A256S/E282D/M302Q/E493D	++
59/60	D272K	++
61/62	E16D/I73V/P74A/A256S/E282D/F366L/Y371F/Q383E/E493D	++
63/64	L412S	++
65/66	K284R	++
67/68	E16D/I73V/A256S/E282D/M302Q/H331P/Y371F/Q383E	++
69/70	D272S	++
71/72	D29R	++
73/74	D272P	++
75/76	P257R	++
77/78	D279R	++
79/80	D272R	++
81/82	K284C	++
83/84	E16D/E130D/A256S/T276Q/H374S/V470T	++
85/86	P257S	++
87/88	V409S	++

Table 4-1. Amylase Activity (Relative to SEQ ID NO: 18)[1]		
89/90	E254S	++
91/92	I495E	++
93/94	K19E/S72T/P345A/E473D	++
95/96	P257V	++
97/98	D29S	++
99/100	E16D/D33E/E130D/A256S/M302Q/Y371F/Q383E/V470T	++
101/102	K284Y	++
103/104	A256S	++
105/106	E254G	++
107/108	R2K/I73V/A256S/E493D	++
109/110	E16D/D33E/I73V/E130D/A256S/E282D/Y371F/H374S/E493D	++
111/112	Q149T	++
113/114	P345A/D388E/D396H/D428E	++
115/116	I495L	++
117/118	F322A	+
119/120	D29G	+
121/122	P259Q	+
123/124	I495Y	+
[1]Levels of increased activity were determined relative to the reference polypeptide of SEQ ID NO: 18, and defined as follows: "+" > 0.9; "++" > 1.1; "+++" > 2; and "++++" > 4.		

[0240] Based on the results shown in **Table 4-1**, SEQ ID NO: 40 was chosen as the parent sequence for the next iteration of protein optimization. Beneficial mutations identified from those listed in **Table 4-2** were recombined into this backbone. The variants were assayed in triplicate for amylase activity at pH 6.8 after pre-incubations with two different conditions: a 1 hr incubation at 50°C, followed by a 1 hr intestinal screen, and a one hour incubation at 50°C, followed by a 1 hr gastric challenge at pH 3.5, as described in Example 3. The results (relative to the results for SEQ ID NO: 40) are shown in **Table 4-2**.

Table 4-2. Alpha-Amylase Activity (Relative to SEQ ID NO: 40)[1]				
SEQ ID NO: (nt/aa)	**Amino Acid Differences (Relative to SEQ ID NO: 40)**	**Amino Acid Differences (Relative to SEQ ID NO: 18)**	**Amylase Activity Post Heat & Intestinal Challenge (Relative to SEQ ID NO: 40)**	**Amylase Activity Post Heat & Gastric Challenge (Relative to SEQ ID NO: 40)**
125/126	D272G/D279R/L412D/D428E/E493D	E16D/D33E/F157Y/A256S/D272G/D279R/M302Q/Y371F/Q383E/L412D/D428E/E493D	+++	++++
127/128	D272G/L412D/D428E	E16D/D33E/F157Y/A256S/D272G/M302Q/Y371F/Q383E/L412D/D428E	+++	+++
129/130	D272G/L412D/E493D	E16D/D33E/F157Y/A256S/D272G/M302Q/Y371F/Q383E/L412D/E493D	+++	+++
131/132	D29R/D272G/D279R/D396H/L412D	E16D/D29R/D33E/F157Y/A256S/D272G/D279R/M302Q/Y371F/Q383E/D396H/L412D	+++	+++
133/134	E130D/E254S/K284S/F322A/H374S/V409S/Q466E	E16D/D33E/E130D/F157Y/E254S/A256S/K284S/M302Q/F322A/Y371F/H374S/Q383E/V409S/Q466E	+++	+++
135/136	E130D/K284S/F322A/H374S/V409S/E473D	E16D/D33E/E130D/F157Y/A256S/K284S/M302Q/F322A/Y371F/H374S/Q383E/V409S/E473D	+++	++
137/138	E130D/P257G/K284S/H374S/V409S/Q466E	E16D/D33E/E130D/F157Y/A256S/P257G/ K284S/M302Q/Y371F/H374S/Q383E/V409S/Q466E	+++	+++
139/140	E130D/Q149R/E254S/K284S/F322A/V409S/I495E	E16D/D33E/E130D/Q149R/F157Y/E254S/A256S/K284S/M302Q/F322A/Y371F/Q383E/V409S/I495E	+++	+++
141/142	E130D/Q149R/P257G/K284S/F322A/V409S/Q466E/E473D	E16D/D33E/E130D/Q149R/F157Y/A256S/P257G/K284S/M302Q/F322A/Y371F/Q383E/V409S/Q466E/E473D	+++	+++
143/144	E254S/K284S/V409S/Q466E/I495E	E16D/D33E/F157Y/E254S/A256S/K284S/M302Q/Y371F/Q383E/V409S/Q466E/I495E	+++	++
145/146	E254S/P257G/K284S/F322A/V409S/E473D	E16D/D33E/F157Y/E254S/A256S/P257G/K284S/M302Q/F322A/Y371F/Q383E/V409S/E473D	+++	++
147/148	E26A/D272G/D279R/L412D/D428E/E493D	E16D/E26A/D33E/F157Y/A256S/D272G/D279R/M302Q/Y371F/Q383E/L412D/D428E/E493D	+++	++++

Table 4-2. Alpha-Amylase Activity (Relative to SEQ ID NO: 40)[1]				
149/150	E26A/D29R/D272G/D279R/L412D/E493D	E16D/E26A/D29R/D33E/F157Y/A256S/D272G/D279R/M302Q/Y371F/Q383E/L412D/E493D	+++	+++
151/152	E26A/D29R/D272G/D396H/L412D	E16D/E26A/D29R/D33E/F157Y/A256S/D272G/M302Q/Y371F/Q383E/D396H/L412D	++	+++
153/154	E26A/D29R/D279R/L412D/D428E	E16D/E26A/D29R/D33E/F157Y/A256S/D279R/M302Q/Y371F/Q383E/L412D/D428E	+++	+++
155/156	E26A/D29R/K158R/D272G/L412D	E16D/E26A/D29R/D33E/F157Y/K158R/A256S/D272G/M302Q/Y371F/Q383E/L412D	+++	+++
157/158	E26A/K158R/D272G/D279R/D388E/L412D/D428E	E16D/E26A/D33E/F157Y/K158R/A256S/D272G/D279R/M302Q/Y371F/Q383E/D388E/L412D/D428E	+++	+++
159/160	E26A/K158R/D272G/L412D	E16D/E26A/D33E/F157Y/K158R/A256S/D272G/M302Q/Y371F/Q383E/L412D	+++	+++
161/162	K158R/D272G/D279R/Q394R/D396H/L412D/D428E/E493D	E16D/D33E/F157Y/K158R/A256S/D272G/D279R/M302Q/Y371F/Q383E/Q394R/D396H/L412D/D428E/E493D	+++	+++
163/164	K158R/D272G/D388E/L412D/D428E/E493D	E16D/D33E/F157Y/K158R/A256S/D272G/M302Q/Y371F/Q383E/D388E/L412D/D428E/E493D	+++	+++
165/166	K158R/D272G/L412D/D428E	E16D/D33E/F157Y/K158R/A256S/D272G/M302Q/Y371F/Q383E/L412D/D428E	++	+++
167/168	K158R/D279R/D388E/D396H/L412D/D428E	E16D/D33E/F157Y/K158R/A256S/D279R/M302Q/Y371F/Q383E/D388E/D396H/L412D/D428E	++	+++
169/170	K284S/F322A/V409S/E473D	E16D/D33E/F157Y/K284S/A256S/M302Q/F322A/Y371F/Q383E/V409S/E473D	+++	++
171/172	Q149R/P257G/K284S/F322A/V409S/Q466E	E16D/D33E/Q149R/F157Y/A256S/P257G/K284S/M302Q/F322A/Y371F/Q383E/V409S/Q466E	+++	+++

[1]Levels of increased activity were determined relative to the reference polypeptide of SEQ ID NO: 40, and defined as follows: "+" > 0.9; "++" > 1.1; "+++" > 2; and "++++" > 3.

[0241] Based on the results shown in **Table 4-2**, SEQ ID NO: 156 was chosen as the parent sequence for the next iteration of protein optimization. Beneficial mutations identified from the results shown in **Table 4-2** were recombined into the backbone. Additionally, to generate new diversity, variants produced with saturation mutagenesis at different positions were also constructed using SEQ ID NO: 156.

[0242] The variants were assayed in triplicate for amylase activity at pH 6.8, after pre-incubation under two different conditions. The first condition was a 1 hour gastric challenge at pH 3.25 and the second condition was a 2 hr gastric challenge at pH 3.25, as described in Example 3. The results (relative to the results for SEQ ID NO: 156) are provided in **Table 4-3**.

Table 4-3. Alpha-Amylase Activity (Relative to SEQ ID NO: 156)[1]

SEQ ID NO: (nt/aa)	Amino Acid Differences (Relative to SEQ ID NO: 156)	Amino Acid Differences (Relative to SEQ ID NO: 18)	Amylase Activity Post 1 Hour Gastric Challenge (Relative to SEQ ID NO: 156)	Amylase Activity Post 2 Hour Gastric Challenge (Relative to SEQ ID NO: 156)
173/174	A114H	E16D/E26A/D29R/D33E/A114H/F157Y/K158R/A256S/D272G/M302Q/Y371F/Q383E/L412D	+++	+++
175/176	K91H	E16D/E26A/D29R/D33E/K91H/F157Y/K158R/A256S/D272G/M302Q/Y371F/Q383E/L412D	+++	+++
177/178	A122P	E16D/E26A/D29R/D33E/A122P/F157Y/K158R/A256S/D272G/M302Q/Y371F/Q383E/L412D	++	++
179/180	E167W	E16D/E26A/D29R/D33E/F157Y/K158R/E167W/A256S/D272G/M302Q/Y371F/Q383E/L412D	++	++
181/182	G183N	E16D/E26A/D29R/D33E/F157Y/K158R/G183N/A256S/D272G/M302Q/Y371F/Q383E/L412D	++	++
183/184	A122R	E16D/E26A/D29R/D33E/A122R/F157Y/K158R/A256S/D272G/M302Q/Y371F/Q383E/L412D	++	++
185/186	N464L	E16D/E26A/D29R/D33E/F157Y/K158R/A256S/D272G/M302Q/Y371F/Q383E/L412D/N464L	++	+

Table 4-3. Alpha-Amylase Activity (Relative to SEQ ID NO: 156)[1]				
187/188	G183E	E16D/E26A/D29R/D33E/F157Y/K158R/G183E/A256S/D272G/M302Q/Y371F/Q383E/L412D	++	++
189/190	R140K	E16D/E26A/D29R/D33E/R140K/F157Y/K158R/A256S/D272G/M302Q/Y371F/Q383E/L412D	++	+
191/192	E397T	E16D/E26A/D29R/D33E/F157Y/K158R/A256S/D272G/M302Q/Y371F/Q383E/E397T/L412D	++	++
193/194	D124R	E16D/E26A/D29R/D33E/D124R/F157Y/K158R/A256S/D272G/M302Q/Y371F/Q383E/L412D	++	++
195/196	K112Q	E16D/E26A/D29R/D33E/K112Q/F157Y/K158R/A256S/D272G/M302Q/Y371F/Q383E/L412D	++	++
197/198	I128W	E16D/E26A/D29R/D33E/I128W/F157Y/K158R/A256S/D272G/M302Q/Y371F/Q383E/L412D	++	++
199/200	G51R	E16D/E26A/D29R/D33E/G51R/F157Y/K158R/A256S/D272G/M302Q/Y371F/Q383E/L412D	++	++
201/202	T276A	E16D/E26A/D29R/D33E/F157Y/K158R/A256S/D272G/T276A/M302Q/Y371F/Q383E/L412D	++	++
203/204	E111A	E16D/E26A/D29R/D33E/E111A/F157Y/K158R/A256S/D272G/M302Q/Y371F/Q383E/L412D	++	+
205/206	E298M	E16D/E26A/D29R/D33E/F157Y/K158R/A256S/D272G/E298M/M302Q/Y371F/Q383E/L412D	++	+
207/208	N37R	E16D/E26A/D29R/D33E/N37R/F157Y/K158R/A256S/D272G/M302Q/Y371F/Q383E/L412D	++	+
209/210	G183V	E16D/E26A/D29R/D33E/F157Y/K158R/G183V/A256S/D272G/M302Q/Y371F/Q383E/L412D	+	+
211/212	Q280L	E16D/E26A/D29R/D33E/F157Y/K158R/A256S/D272G/Q280L/M302Q/Y371F/Q383E/L412D	+	+

Table 4-3. Alpha-Amylase Activity (Relative to SEQ ID NO: 156)[1]				
213/214	L194R	E16D/E26A/D29R/D33E/F157Y/K158R/L194R/A256S/D272G/M302Q/Y371F/Q383E/L412D	+	++
215/216	T276K	E16D/E26A/D29R/D33E/F157Y/K158R/A256S/D272G/T276K/M302Q/Y371F/Q383E/L412D	+	++
217/218	E171I	E16D/E26A/D29R/D33E/F157Y/K158R/E171I/A256S/D272G/M302Q/Y371F/Q383E/L412D	+	++
219/220	L194E	E16D/E26A/D29R/D33E/F157Y/K158R/L194E/A256S/D272G/M302Q/Y371F/Q383E/L412D	+	++
221/222	E298K	E16D/E26A/D29R/D33E/F157Y/K158R/A256S/D272G/E298K/M302Q/Y371F/Q383E/L412D	+	++
[1]Levels of increased activity were determined relative to the reference polypeptide of SEQ ID NO: 156, and defined as follows: "+" > 0.9; "++" > 1.1; and "+++" > 2.				

[0243] Based on the results shown in **Table 4-3**, SEQ ID NO: 174 was chosen as the parent sequence for the next iteration of protein optimization. Beneficial mutations identified from **Table 4-2** and **Table 4-3**, and diversity from homologs, were recombined into this backbone. The variants were assayed in singlicate for amylase activity at pH 6.8 after pre-incubation with a 1 hour gastric challenge at pH 3.25, as described in Example 3. The results (relative to the results for SEQ ID NO: 174) are provided in **Table 4-4**.

Table 4-4. Alpha-Amylase Activity (Relative to SEQ ID NO: 174)[1]			
SEQ ID NO: (nt/aa)	**Amino Acid Differences (Relative to SEQ ID NO: 174)**	**Amino Acid Differences (Relative to SEQ ID NO: 18)**	**Amylase Activity Post Gastric Challenge (Relative to SEQ ID NO: 174)**
223/224	A122P/V409S	E16D/E26A/D29R/D33E/A114H/A122P/F157Y/K158R/A256S/D272G/M302Q/Y371F/Q383E/V409S/L412D	++
225/226	A122R/E130D/E171I/F322A/V409S	E16D/E26A/D29R/D33E/A114H/A122R/E130D/F157Y/K158R/E171I/A256S/D272G/M302Q/F322A/Y371F/Q383E/V409S/L412D	++
227/228	A122R/I128W	E16D/E26A/D29R/D33E/A114H/A122R/I128W/F157Y/K158R/A256S/D272G/M302Q/Y371F/Q383E/L412D	++

Table 4-4. Alpha-Amylase Activity (Relative to SEQ ID NO: 174)[1]			
229/230	A122R/I128W/L194R/V409S	E16D/E26A/D29R/D33E/A114H/A122R/I128W/F157Y/K158R/L194R/A256S/D272G/M302Q/Y371F/Q383E/V409S/L412D	++
231/232	A145G/T227L/K295N/C481V	E16D/E26A/D29R/D33E/A114H/A145G/F157Y/K158R/T227L/A256S/D272G/K295N/M302Q/Y371F/Q383E/L412D/C481V	++
233/234	A145G/T309S/C481V	E16D/E26A/D29R/D33E/A114H/A145G/F157Y/K158R/A256S/D272G/M302Q/T309S/Y371F/Q383E/L412D/C481V	++
235/236	F322A	E16D/E26A/D29R/D33E/A114H/F157Y/K158R/A256S/D272G/M302Q/F322A/Y371F/Q383E/L412D	++
237/238	F322A/V409S	E16D/E26A/D29R/D33E/A114H/F157Y/K158R/A256S/D272G/M302Q/F322A/Y371F/Q383E/V409S/L412D	++
239/240	F480T/C481V	E16D/E26A/D29R/D33E/A114H/F157Y/K158R/A256S/D272G/M302Q/Y371F/Q383E/L412D/F480T/C481V	++
241/242	G137A/A145G/K295N	E16D/E26A/D29R/D33E/A114H/G137A/A145G/F157Y/K158R/A256S/D272G/K295N/M302Q/Y371F/Q383E/L412D	++
243/244	G137A/A145G/T227L/Q394E/F480P/C481V	E16D/E26A/D29R/D33E/A114H/G137A/A145G/F157Y/K158R/T227L/A256S/D272G/M302Q/Y371F/Q383E/ Q394E/L412D/F480P/C481V	++
245/246	G183N	E16D/E26A/D29R/D33E/A114H/F157Y/K158R/G183N A256S/D272G/M302Q/Y371F/Q383E/L412D	++
247/248	K295N/Q394E	E16D/E26A/D29R/D33E/A114H/F157Y/K158R/A256S/D272G/K295N/M302Q/Y371F/Q383E/Q394E/L412D	++
249/250	K91H	E16D/E26A/D29R/D33E/K91H/A114H/F157Y/K158R/A256S/D272G/M302Q/Y371F/Q383E/L412D	++
251/252	K91H/A122P	E16D/E26A/D29R/D33E/K91H/A114H/A122P/F157Y/K158R/A256S/D272G/M302Q/Y371F/Q383E/L412D	+++
253/254	K91H/A122P/E130D/G183N/L194R	E16D/E26A/D29R/D33E/K91H/A114H/A122P/E130D/F157Y/K158R/G183N/L194R/A256S/D272G/M302Q/Y371F/Q383E/L412D	+++
255/256	K91H/A122P/E130D/L194R/F322A	E16D/E26A/D29R/D33E/K91H/A114H/A122P/E130D/F157Y/K158R/L194R/A256S/D272G/M302Q/F322A/Y371F/Q383E/L412D	++
257/258	K91H/A122R	E16D/E26A/D29R/D33E/K91H/A114H/A122R/F157Y/K158R/A256S/D272G/M302Q/Y371F/Q383E/L412D	+++

Table 4-4. Alpha-Amylase Activity (Relative to SEQ ID NO: 174)[1]			
259/260	K91H/A122R/E130D /E167W/G183N/L19 4R/V409S	E16D/E26A/D29R/D33E/K91H/A114H/A122R/E130D/ F157Y/K158R/E167W/G183N/L194R/A256S/D272G/ M302Q/Y371F/Q383E/ V409S/L412D	+++
261/262	K91H/A122R/E130D /E171I/G183N	E16D/E26A/D29R/D33E/K91H/A114H/A122R/E130D/ F157Y/K158R/E171I/G183N/A256S/D272G/M302Q/Y 371F/Q383E/L412D	+++
263/264	K91H/A122R/E130D /L194R	E16D/E26A/D29R/D33E/K91H/A114H/A122R/ E130D/F157Y/K158R/L194R/A256S/D272G/M302Q/ Y371F/Q383E/L412D	+++
265/266	K91H/A122R/E167 W/E171I/L194R	E16D/E26A/D29R/D33E/K91H/A114H/A122R/F157Y/ K158R/E167W/E171I/L194R/A256S/D272G/M302Q/Y 371F/Q383E/L412D	+++
267/268	K91H/A122R/E167 W/E171I/L194R/F32 2A	E16D/E26A/D29R/D33E/K91H/A114H/A122R/F157Y/ K158R/E167W/E171I/L194R/A256S/D272G/M302Q/F 322A/Y371F/Q383E/L412D	+++
269/270	K91H/A122R/E171I/ G183N/L194R/V409 S	E16D/E26A/D29R/D33E/K91H/A114H/A122R/F157Y/ K158R/E171I/G183N/L194R/A256S/D272G/M302Q/Y 371F/Q383E/V409S/L412D	+++
271/272	K91H/A122R/I128W /E130D/E167W/E17 1I/V409S	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/ E130D/F157Y/K158R/E167W/E171I/A256S/D272G/M 302Q/Y371F/Q383E/V409S/L412D	+++
273/274	K91H/A122R/I128W /E130D/F322A	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/ E130D/F157Y/K158R/A256S/D272G/M302Q/F322A/ Y371F/Q383E/L412D	+++
275/276	K91H/A122R/I128W /E130D/G183N/F322 A	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/ E130D/F157Y/K158R/G183N/A256S/D272G/M302Q/ F322A/Y371F/Q383E/L412D	+++
277/278	K91H/A122R/I128W /E130D/L194R	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/ E130D/F157Y/K158R/L194R/A256S/D272G/M302Q/ Y371F/Q383E/L412D	+++
279/280	K91H/A122R/I128W /E171I/G183N/L194 R/F322A	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/ F157Y/K158R/E171I/G183N/L194R/A256S/D272G/M 302Q/F322A/Y371F/Q383E/L412D	+++
281/282	K91H/A122R/I128W /G183N/V409S	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/ F157Y/K158R/G183N/A256S/D272G/M302Q/Y371F/ Q383E/V409S/L412D	++
283/284	K91H/E130D/E171I/ G183N/F322A/V409 S	E16D/E26A/D29R/D33E/K91H/A114H/E130D/F157Y/ K158R/E171I/G183N/A256S/D272G/M302Q/F322A/Y 371F/Q383E/V409S/L412D	++

Table 4-4. Alpha-Amylase Activity (Relative to SEQ ID NO: 174)[1]			
285/286	K91H/E167W/E171I	E16D/E26A/D29R/D33E/K91H/A114H/F157Y/K158R/E167W/E171I/A256S/D272G/M302Q/Y371F/Q383E/L412D	+++
287/288	K91H/E167W/F322A	E16D/E26A/D29R/D33E/A114H/F157Y/K158R/A256S/D272G/M302Q/Y371F/Q383E/L412D K91H/E167W/F322A	++
289/290	K91H/E167W/G183N/L194R	E16D/E26A/D29R/D33E/K91H/A114H/F157Y/K158R/E167W/G183N/L194R/A256S/D272G/M302Q/Y371F/Q383E/L412D	+++
291/292	K91H/F322A	E16D/E26A/D29R/D33E/K91H/A114H/F157Y/K158R/A256S/D272G/M302Q/F322A/Y371F/Q383E/L412D	++
293/294	K91H/G183N	E16D/E26A/D29R/D33E/K91H/A114H/F157Y/K158R/G183NA256S/D272G/M302Q/Y371F/Q383E/L412D	++
295/296	K91H/G183N/F322A/V409S	E16D/E26A/D29R/D33E/K91H/A114H/F157Y/K158R/G183N/A256S/D272G/M302Q/F322A/Y371F/Q383E/V409S/L412D	++
297/298	K91H/L194R	E16D/E26A/D29R/D33E/K91H/A114H/F157Y/K158R/L194R/A256S/D272G/M302Q/Y371F/Q383E/L412D	++
299/300	K91H/V409S	E16D/E26A/D29R/D33E/K91H/A114H/F157Y/K158R/A256S/D272G/M302Q/Y371F/Q383E/V409S/L412D	++
301/302	L24V	E16D/L24V/E26A/D29R/D33E/A114H/F157Y/K158R/A256S/D272G/M302Q/Y371F/Q383E/L412D	++
303/304	Q394E	E16D/E26A/D29R/D33E/A114H/F157Y/K158R/A256S/D272G/M302Q/Y371F/Q383E/Q394E/L412D	++
305/306	T227L	E16D/E26A/D29R/D33E/A114H/F157Y/K158R/T227L/A256S/D272G/M302Q/Y371F/Q383E/L412D	++
[1]Levels of increased activity were determined relative to the reference polypeptide of SEQ ID NO: 174, and defined as follows: "+" > 0.9; "++" > 1.1; and "+++" > 2.			

[0244] Based on the results shown in **Table 4-4**, SEQ ID NO: 276 was chosen as the parent sequence for the next iteration of protein optimization. Beneficial mutations identified based on the results shown in **Table 4-4**, and mutations to revert variant sequences to wild-type sequences were recombined into this backbone. In addition, to generate new diversity, variants generated with saturation mutagenesis at different positions were also constructed using SEQ ID NO: 276. The variants were assayed in triplicate for amylase activity at pH 6.8 after pre-incubation under two different conditions. The first condition was a 1 hour gastric challenge at pH 2.75, and the second

condition was a 1 hour intestinal challenge, as described in Example 3. The results (relative to the results for SEQ ID NO: 276) are provided in **Table 4-5**.

Table 4-5. Alpha-Amylase Activity (Relative to SEQ ID NO: 276)[1]

SEQ ID NO: (nt/aa)	Amino Acid Differences (Relative to SEQ ID NO: 276)	Amino Acid Differences (Relative to SEQ ID NO: 18)	Amylase Activity Post Intestinal Challenge (Relative to SEQ ID NO: 276)	Amylase Activity Post Gastric Challenge (Relative to SEQ ID NO: 276)
307/308	Q394G	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/F157Y/K158R/G183N/A256S/D272G/M302Q/F322A/Y371F/Q383E/Q394G/L412D	++	+++
309/310	Q394N	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/F157Y/K158R/G183N/A256S/D272G/M302Q/F322A/Y371F/Q383E/Q394N/L412D	++	+++
311/312	Q394S	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/F157Y/K158R/G183N/A256S/D272G/M302Q/F322A/Y371F/Q383E/Q394S/L412D	++	+++
313/314	D16E/R29D/E33D/A145G/S256A/Q302M	E26A/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/D272G/F322A/Y371F/Q383E/L412D		+++
315/316	P349R	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/F157Y/K158R/G183N/A256S/D272G/M302Q/F322A/Y371F/Q383E/P349R/L412D		+++
317/318	D16E/A26E/R29D/W128I/A145G/S256A/T309S/E383Q	D33E/K91H/A114H/A122R/E130D/A145G/F157Y/K158R/G183N/D272G/M302Q/T309S/F322A/Y371F/L412D	+	+++
319/320	A26E/R29D/R122A/D130E/A145G/N183G/S256A/G272D/T309S/Q394E	E16D/D33E/K91H/A114H/I128W/A145G/F157Y/K158R/M302Q/T309S/F322A/Y371F/Q383E/ Q394E/L412D	+	+++
321/322	A26E/R29D/A145G/S256A/G272D/Q302M/T309S/A322F/C481V	E16D/D33E/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/T309S/Y371F/Q383E/L412D/C481V		+++

Table 4-5. Alpha-Amylase Activity (Relative to SEQ ID NO: 276)[1]				
323/324	G380R	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/F157Y/K158R/G183N/A256S/D272G/M302Q/F322A/Y371F/G380R/Q383E/L412D		+++
325/326	D130E/A145G/Q302M/T309S	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/A145G/F157Y/K158R/G183N/A256S/D272G/T309S/F322A/Y371F/Q383E/L412D	+	+++
327/328	A26E/E33D/A145G/T309S/A322F/E383Q	E16D/D29R/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/A256S/D272G/M302Q/T309S/Y371F/L412D	++	++
329/330	A145G/Q302M/T309S	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/A256S/D272G/T309S/F322A/Y371F/Q383E/L412D		++
331/332	A26E/R29D/A145G/Y157F/S256A/Q302M/A322F/C481V	E16D/D33E/K91H/A114H/A122R/I128W/E130D/A145G/K158R/G183N/D272G/Y371F/Q383E/L412D/C481V		++
333/334	A26E/R29D/E33D/A145G/Y157F/N183G/S256A/T309S/E383Q	E16D/K91H/A114H/A122R/I128W/E130D/A145G/K158R/D272G/M302Q/T309S/F322A/Y371F/L412D		++
335/336	R29D/D130E/A145G/S256A/G272D/F371Y/Q394E	E16D/E26A/D33E/K91H/A114H/A122R/I128W/A145G/F157Y/K158R/G183N/M302Q/F322A/Q383E/Q394E/L412		++
337/338	A26E/A145G/N183G/S256A/T309S/E383Q	E16D/D29R/D33E/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/D272G/M302Q/T309S/F322A/Y371F/L412D	+	++
339/340	D130E/A145G/S256A/G272D/F371Y	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/A145G/F157Y/K158R/G183N/M302Q/F322A/Q383E/L412D		++
341/342	H91K/D130E/A145G/R158K/N183G/E383Q	E16D/E26A/D29R/D33E/A114H/A122R/I128W/A145G/F157Y/A256S/D272G/M302Q/F322A/Y371F/L412D	+	++

Table 4-5. Alpha-Amylase Activity (Relative to SEQ ID NO: 276)[1]				
343/344	D16E/A26E/A145G/Q302M	D29R/D33E/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/A256S/D272G/F322A/Y371F/Q383E/L412D		++
345/346	D16E/A26E/E33D/A145G/R158K/E383Q/Q394E	D29R/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/G183N/A256S/D272G/M302Q/F322A/Y371F/Q394E/L412D		++
347/348	D16E/A26E/E33D/W128I/D130E/A145G/Q302M/T309S/A322F/F371Y	D29R/K91H/A114H/A122R/A145G/F157Y/K158R/G183N/A256S/D272G/T309S/Q383E/L412D		++
349/350	A26E/R29D/E33D/D130E/A145G/Y157F/R158K/N183G/Q394E	E16D//K91H/A114H/A122R/I128W/A145G/A256S/D272G/M302Q/F322A/Y371F/Q383E/Q394E/L412D	+	++
351/352	R29D/A145G/N183G/Q302M/T309S/D412L	E16D/E26A/D33E/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/A256S/D272G/T309S/F322A/Y371F/Q383E		++
353/354	R29D/R122A/A145G/R158K/E383Q	E16D/E26A/D33E/K91H/A114H/I128W/E130D/A145G/F157Y/G183N/A256S/D272G/M302Q/F322A/Y371F/L412D		++
355/356	A26E/E33D/H91K/A145G/G272D/Q302M/C481V	E16D/D29R/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/A256S/F322A/Y371F/Q383E/L412D/C481V		++
357/358	E33D/R122A/A145G/G272D/T309S/D412L	E16D/E26A/D29R/K91H/A114H/I128W/E130D/A145G/F157Y/K158R/G183N/A256S/M302Q/T309S/F322A/Y371F/Q383E		++
359/360	N360G	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/F157Y/K158R/G183N/A256S/D272G/M302Q/F322A/N360G/Y371F/Q383E/L412D	+	++

Table 4-5. Alpha-Amylase Activity (Relative to SEQ ID NO: 276)[1]				
361/362	R29D/T309S/Q394E	E16D/E26A/D33E/K91H/A114H/A122R/I128W/E130D/F157Y/K158R/G183N/A256S/D272G/M302Q/T309S/F322A/Y371F/Q383E/Q394E/L412D		++
363/364	T309A	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/F157Y/K158R/G183N/A256S/D272G/M302Q/T309A/F322A/Y371F/Q383E/L412D	+	++
365/366	D16E/A26E/E33D/H114A/A145G/T309S/E383Q/Q394E	D29R/K91H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/A256S/D272G/M302Q/T309S/F322A/Y371F/Q394E/L412D	+	++
367/368	A26E/H114A/A145G/A322F	E16D/D29R/D33E/K91H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/A256S/D272G/M302Q/Y371F/Q383E/L412D	+	++
369/370	D130E/G272D/C481V	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/F157Y/K158R/G183N/A256S/M302Q/F322A/Y371F/Q383E/L412D/C481V		+
371/372	G463M	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/F157Y/K158R/G183N/A256S/D272G/M302Q/F322A/Y371F/Q383E/L412D/G463M	++	+
373/374	S268T	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/F157Y/K158R/G183N/A256S/S268T/D272G/M302Q/F322A/Y371F/Q383E/L412D	+	
375/376	G483T	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/F157Y/K158R/G183N/A256S/D272G/M302Q/F322A/Y371F/Q383E/L412D/G483T	+	
377/378	G18S	E16D/G18S/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/F157Y/K158R/G183N/A256S/D272G/M302Q/F322A/Y371F/Q383E/L412D	++	

Table 4-5. Alpha-Amylase Activity (Relative to SEQ ID NO: 276)[1]				
379/380	H91K/T309S/E383Q	E16D/E26A/D29R/D33E/A114H/A122R/I128W/E130D/F157Y/K158R/G183N/A256S/D272G/M302Q/T309S/F322A/Y371F/L412D	++	
[1]Levels of increased activity were determined relative to the reference polypeptide of SEQ ID NO: 276, and defined as follows: "+" > 0.9; "++" > 1.1; and "+++" > 2.				

[0245] Based on the results shown in **Table 4-5**, SEQ ID NO: 308 was chosen as the parent sequence for the next iteration of protein optimization. Beneficial mutations identified from **Table 4-5**, and diversity from homologs were recombined into this backbone. In addition, to generate new diversity, variants with a single mutation at different positions were also constructed using SEQ ID NO: 308. The variants were assayed in triplicate for amylase activity at pH 6.8 after pre-incubations under two different conditions. The first condition was a 2 hour gastric challenge at pH 2.5 and the second condition was a 2 hour intestinal challenge, as described in Example 3. The results (relative to the results for SEQ ID NO: 308) are provided in **Table 4-6**.

Table 4.6 Alpha-Amylase Activity (Relative to SEQ ID NO: 308)[1]				
SEQ ID NO: (nt/aa)	**Amino Acid Differences (Relative to SEQ ID NO: 308)**	**Amino Acid Differences (Relative to SEQ ID NO: 18)**	**Amylase Activity Post Gastric Challenge (Relative to SEQ ID NO: 308)**	**Amylase Activity Post Intestinal Challenge (Relative to SEQ ID NO: 308)**
381/382	A81E/T313D/I495L	E16D/E26A/D29R/D33E/A81E/K91H/A114H/A122R/I128W/E130D/F157Y/K158R/G183N/A256S/D272G/M302Q/T313D/F322A/Y371F/Q383E/Q394G/L412D/I495L	+	++
383/384	A81E/P259D	E16D/E26A/D29R/D33E/A81E/K91H/A114H/A122R/I128W/E130D/F157Y/K158R/G183N/A256S/P259D/D272G/M302Q/F322A/Y371F/Q383E/Q394G/L412D	+	+
385/386	T313D	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/F157Y/K158R/G183N/A256S/D272G/M302Q/T313D/F322A/Y371F/Q383E/Q394G/L412D	+	+
387/388	R29A	E16D/E26A/D29A/D33E/K91H/A114H/A122R/I128W/E130D/F157Y/K158R/G183N/A256S/D272G/M302Q/F322A/Y371F/Q383E/Q394G/L412D	+	+

Table 4.6 Alpha-Amylase Activity (Relative to SEQ ID NO: 308)[1]				
389/390	E473D	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/F157Y/K158R/G183N/A256S/D272G/M302Q/F322A/Y371F/Q383E/Q394G/L412D/E473D	++	+
391/392	P259D/T313D/A338S	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/F157Y/K158R/G183N/A256S/P259D/D272G/M302Q/T313D/F322A/A338S/Y371F/Q383E/Q394G/L412D	++	+
393/394	R92E/P257E/K258Q/A338S/R468T	E16D/E26A/D29R/D33E/K91H/R92E/A114H/A122R/I128W/E130D/F157Y/K158R/G183N/A256S/P257E/K258Q/D272G/M302Q/F322A/A338S/Y371F/Q383E/Q394G/L412D/R468T	++	+
395/396	F413Y	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/F157Y/K158R/G183N/A256S/D272G/M302Q/F322A/Y371F/Q383E/Q394G/L412D/F413Y	++	+
397/398	K246R	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/F157Y/K158R/G183N/K246R/A256S/D272G/M302Q/F322A/Y371F/Q383E/Q394G/L412D	++	+
399/400	M294L	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/F157Y/K158R/G183N/A256S/D272G/M294L/M302Q/F322A/Y371F/Q383E/Q394G/L412D	++	+
401/402	E225D	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/F157Y/K158R/G183N/E225D/A256S/D272G/M302Q/F322A/Y371F/Q383E/Q394G/L412D	++	+
403/404	F413Y/R468I	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/F157Y/K158R/G183N/A256S/D272G/M302Q/F322A/Y371F/Q383E/Q394G/L412D/F413Y/R468I	++	+
405/406	R92E/K258Q	E16D/E26A/D29R/D33E/K91H/R92E/A114H/A122R/I128W/E130D/F157Y/K158R/G183N/A256S/K258Q/D272G/M302Q/F322A/Y371F/Q383E/Q394G/L412D	++	+

Table 4.6 Alpha-Amylase Activity (Relative to SEQ ID NO: 308)[1]				
407/408	H448T	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/F157Y/K158R/G183N/A256S/D272G/M302Q/F322A/Y371F/Q383E/Q394G/L412D/H448T	++	+
409/410	Q226T	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/F157Y/K158R/G183N/Q226T/A256S/D272G/M302Q/F322A/Y371F/Q383E/Q394G/L412D	++	+
411/412	P349R	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/F157Y/K158R/G183N/A256S/D272G/M302Q/F322A/P349R/Y371F/Q383E/Q394G/L412D	++	
413/414	V178I	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/F157Y/K158R/V178I/G183N/A256S/D272G/M302Q/F322A/Y371F/Q383E/Q394G/L412D	++	+
415/416	D94G/P349R/I491L	E16D/E26A/D29R/D33E/K91H/D94G/A114H/A122R/I128W/E130D/F157Y/K158R/G183N/A256S/D272G/M302Q/F322A/P349R/Y371F/Q383E/Q394G/L412D/I491L	++	
417/418	E270D/P349R	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/F157Y/K158R/G183N/A256S/E270D/D272G/M302Q/F322A/P349R/Y371F/Q383E/Q394G/L412D	++	
419/420	D94G/E270D/R301K/P349R/G394E/D442E	E16D/E26A/D29R/D33E/K91H/D94G/A114H/A122R/I128W/E130D/F157Y/K158R/G183N/A256S/E270D/D272G/R301K/M302Q/F322A/P349R/Y371F/Q383E/Q394E/L412D/D442E	++	+
421/422	A145G/E270D	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/A256S/E270D/D272G/M302Q/F322A/Y371F/Q383E/Q394G/L412D	++	+
423/424	N37T/D124N/E250D/E270D/P349R/G380R/G394E/D442E/I491L	E16D/E26A/D29R/D33E/N37T/K91H/A114H/A122R/D124N/I128W/E130D/F157Y/K158R/G183N/E250D/A256S/E270D/D272G/M302Q/F322A/P349R/Y371F/G380R/Q383E/Q394E/L412D/D442E/I491L	++	

Table 4.6 Alpha-Amylase Activity (Relative to SEQ ID NO: 308)[1]				
425/426	E250D/P349R/D442E	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/F157Y/K158R/G183N/E250D/A256S/D272G/M302Q/F322A/P349R/Y371F/Q383E/Q394G/L412D/D442E	++	
427/428	N37T/A145G	E16D/E26A/D29R/D33E/N37T/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/A256S/D272G/M302Q/F322A/Y371F/Q383E/Q394G/L412D	++	+
429/430	N37T/A145G/K258S/D442E/I491L	E16D/E26A/D29R/D33E/N37T/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/A256S/K258S/D272G/M302Q/F322A/Y371F/Q383E/Q394G/L412D/D442E/I491L	++	+
431/432	P349R/G380R/D442E	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/F157Y/K158R/G183N/A256S/D272G/M302Q/F322A/P349R/Y371F/G380R/Q383E/Q394G/L412D/D442E	+++	
433/434	D94G/Q127E/I132V/A145G/E250D/P349R	E16D/E26A/D29R/D33E/K91H/D94G/A114H/A122R/Q127E/I128W/E130D/I132V/A145G//F157Y/K158R/G183N/E250D/A256S/D272G/M302Q/F322A/P349R/Y371F/Q383E/Q394G/L412D	+++	
435/436	M286T/A338S	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/F157Y/K158R/G183N/A256S/D272G/M286T/M302Q/F322A/A338S/Y371F/Q383E/Q394G/L412D	+++	+
437/438	M38I/P349R/I491L	E16D/E26A/D29R/D33E/M38I/K91H/A114H/A122R/I128W/E130D/F157Y/K158R/G183N/A256S/D272G/M302Q/F322A/P349R/Y371F/Q383E/Q394G/L412D/I491L	+++	
439/440	N37T/A145G/E250D/R301K/P349R/G394E	E16D/E26A/D29R/D33E/N37T/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/E250D/A256S/D272G/R301K/M302Q/F322A/P349R/Y371F/Q383E/Q394E/L412D	+++	

[1]Levels of increased activity were determined relative to the reference polypeptide of SEQ ID NO: 308, and defined as follows: "+" > 0.9; "++" > 1.1; and "+++" > 2.

[0246] Based on the results shown in **Table 4-6**, SEQ ID NO: 422 was chosen as the parent sequence for the next iteration of protein optimization. Beneficial mutations identified based on the results shown in **Table 4-6** were recombined into this backbone. The variants were assayed in singlicate for amylase activity at pH 6.8 after pre-incubation under two different conditions, the first being a 2 hour gastric challenge at pH 2.3, and the second being a 2 hour intestinal challenge, as described in Example 3. The results (relative to the results for SEQ ID NO: 422) are provided in **Table 4-7**.

Table 4-7. Alpha-Amylase Activity (Relative to SEQ ID NO: 422)[1]

SEQ ID NO: (nt/aa)	Amino Acid Differences (Relative to SEQ ID NO: 422)	Amino Acid Differences (Relative to SEQ ID NO: 18)	Amylase Activity Post Intestinal Challenge (Relative to SEQ ID NO: 422)	Amylase Activity Post Gastric Challenge (Relative to SEQ ID NO: 422)
441/442	A338S/H448T	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/A256S/E270D/D272G/M302Q/F322A/A338S/Y371F/Q383E/Q394G/L412D/H448T	+	+
443/444	E184K/K246R/K258S/G380R	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/E184K/K246R/A256S/K258S/E270D/D272G/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D		++
445/446	F413Y	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/A256S/E270D/D272G/M302Q/F322A/Y371F/Q383E/Q394G/L412D/F413Y	++	+
447/448	K246R	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/K246R/A256S/E270D/D272G/M302Q/F322A/Y371F/Q383E/Q394G/L412D	+	++
449/450	K246R/A338S	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/K246R/A256S/E270D/D272G/M302Q/F322A/A338S/Y371F/Q383E/Q394G/L412D	++	

Table 4-7. Alpha-Amylase Activity (Relative to SEQ ID NO: 422)[1]				
451/452	K246R/F413Y	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/K246R/A256S/E270D/D272G/M302Q/F322A/Y371F/Q383E/Q394G/L412D/F413Y	++	
453/454	K246R/M286T	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/K246R/A256S/E270D/D272G/M286T/M302Q/F322A/Y371F/Q383E/Q394G/L412D	+++	++
455/456	K246R/M286T/G380R/F413Y	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/K246R/A256S/E270D/D272G/M286T/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y	+	++
457/458	K246T	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/K246T/A256S/E270D/D272G/M302Q/F322A/Y371F/Q383E/Q394G/L412D		+
459/460	K258S/M286T/F413Y	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/A256S/K258S/E270D/D272G/M286T/M302Q/F322A/Y371F/Q383E/Q394G/L412D/F413Y	++	++
461/462	M286T	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/A256S/E270D/D272G/M286T/M302Q/F322A/Y371F/Q383E/Q394G/L412D	++	++
463/464	M286T/F413Y/H448T	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/A256S/E270D/D272G/M286T/M302Q/F322A/Y371F/Q383E/Q394G/L412D/F413Y/H448T	++	++

Table 4-7. Alpha-Amylase Activity (Relative to SEQ ID NO: 422)[1]				
465/466	M38I	E16D/E26A/D29R/D33E/M38I/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/A256S/E270D/D272G/M302Q/F322A/Y371F/Q383E/Q394G/L412D	++	++
467/468	M38I/H448T	E16D/E26A/D29R/D33E/M38I/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/A256S/E270D/D272G/M302Q/F322A/Y371F/Q383E/Q394G/L412D/H448T	++	++
469/470	M38I/K246R/M286T	E16D/E26A/D29R/D33E/M38I/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/K246R/A256S/E270D/D272G/M286T/M302Q/F322A/Y371F/Q383E/Q394G/L412D	++	+++
471/472	M38I/K246R/M286T/G380R	E16D/E26A/D29R/D33E/M38I/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/K246R/A256S/E270D/D272G/M286T/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D	+	+++
473/474	M38I/K258S	E16D/E26A/D29R/D33E/M38I/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/A256S/K258S/E270D/D272G/M302Q/F322A/Y371F/Q383E/Q394G/L412D	++	++
475/476	M38I/M286T	E16D/E26A/D29R/D33E/M38I/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/A256S/E270D/D272G/M286T/M302Q/F322A/Y371F/Q383E/Q394G/L412D	++	+++
477/478	M38I/M286T/F413Y/H448T	E16D/E26A/D29R/D33E/M38I/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/A256S/E270D/D272G/M286T/M302Q/F322A/Y371F/Q383E/Q394G/L412D/F413Y/H448T	++	+++

Table 4-7. Alpha-Amylase Activity (Relative to SEQ ID NO: 422)[1]				
479/480	M38I/M286T/H448T	E16D/E26A/D29R/D33E/M38I/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/A256S/E270D/D272G/M286T/M302Q/F322A/Y371F/Q383E/Q394G/L412D/H448T	++	++
481/482	M38I/Q226T/A338S/P349R/G380R	E16D/E26A/D29R/D33E/M38I/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/Q226T/A256S/E270D/D272G/M302Q/F322A/A338S/P349R/Y371F/G380R/Q383E/Q394G/L412D		+++
483/484	M38I/Q226T/F413Y/H448T	E16D/E26A/D29R/D33E/M38I/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/Q226T/A256S/E270D/D272G/M302Q/F322A/Y371F/Q383E/Q394G/L412D/F413Y/H448T	++	++
485/486	M38I/Q226T/K246R/K258S/M286T	E16D/E26A/D29R/D33E/M38I/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/Q226T/K246R/A256S/K258S/E270D/D272G/M286T/M302Q/F322A/Y371F/Q383E/Q394G/L412D	+	++
487/488	M38I/Q226T/K258S/M286T/A338S/G380R/H448T	E16D/E26A/D29R/D33E/M38I/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/Q226T/A256S/K258S/E270D/D272G/M286T/M302Q/F322A/A338S/Y371F/G380R/Q383E/Q394G/L412D/H448T		+++
489/490	M38I/Q226T/K258S/P349R/F413Y	E16D/E26A/D29R/D33E/M38I/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/Q226T/A256S/K258S/E270D/D272G/M302Q/F322A/P349R/Y371F/Q383E/Q394G/L412D/F413Y		++
491/492	M38I/Q226T/M286T	E16D/E26A/D29R/D33E/M38I/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/Q226T/A256S/E270D/D272G/M286T/M302Q/F322A/Y371F/Q383E/Q394G/L412D	++	++

Table 4-7. Alpha-Amylase Activity (Relative to SEQ ID NO: 422)[1]				
493/494	M38I/Q226T/M286T/A338S/G380R	E16D/E26A/D29R/D33E/M38I/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/Q226T/A256S/E270D/D272G/M286T/M302Q/F322A/A338S/Y371F/G380R/Q383E/Q394G/L412D		+++
495/496	M38I/V178I/M286T/H448T	E16D/E26A/D29R/D33E/M38I/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/V178I/G183N/A256S/E270D/D272G/M286T/M302Q/F322A/Y371F/Q383E/Q394G/L412D/H448T		+++
497/498	M38I/V178I/P349R/H448T	E16D/E26A/D29R/D33E/M38I/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/V178I/G183N/A256S/E270D/D272G/M302Q/F322A/P349R/Y371F/Q383E/Q394G/L412D/H448T		+++
499/500	M38I/V178I/Q226T/M286T/A338S	E16D/E26A/D29R/D33E/M38I/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/V178I/G183N/Q226T/A256S/E270D/D272G/M286T/M302Q/F322A/A338S/Y371F/Q383E/Q394G/L412D		+++
501/502	P349R	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/A256S/E270D/D272G/M302Q/F322A/P349R/Y371F/Q383E/Q394G/L412D		++
503/504	Q226T	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/Q226T/A256S/E270D/D272G/M302Q/F322A/Y371F/Q383E/Q394G/L412D	++	++
505/506	Q226T/K246R/F413Y	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/Q226T/K246R/A256S/E270D/D272G/M302Q/F322A/Y371F/Q383E/Q394G/L412D/F413Y	++	++

Table 4-7. Alpha-Amylase Activity (Relative to SEQ ID NO: 422)[1]				
507/508	Q226T/K246R/M286T/P349R/H448T	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/Q226T/K246R/A256S/E270D/D272G/M286T/M302Q/F322A/P349R/Y371F/Q383E/Q394G/L412D/H448T		+++
509/510	Q226T/K258S/M286T/F413Y/H448T	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/Q226T/A256S/K258S/E270D/D272G/M286T/M302Q/F322A/Y371F/Q383E/Q394G/L412D/F413Y/H448T	++	++
511/512	Q226T/K258S/M286T/P349R/G380R	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/Q226T/A256S/K258S/E270D/D272G/M286T/M302Q/F322A/P349R/Y371F/G380R/Q383E/Q394G/L412D		+++
513/514	Q226T/M286T	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/Q226T/A256S/E270D/D272G/M286T/M302Q/F322A/Y371F/Q383E/Q394G/L412D	++	++
515/516	Q226T/M286T/G380R/H448T	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/Q226T/A256S/E270D/D272G/M286T/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/H448T		+++
517/518	Q226T/P349R/G380R	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/Q226T/A256S/E270D/D272G/M302Q/F322A/P349R/Y371F/G380R/Q383E/Q394G/L412D		++
519/520	V178I	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/V178I/G183N/A256S/E270D/D272G/M302Q/F322A/Y371F/Q383E/Q394G/L412D		++

Table 4-7. Alpha-Amylase Activity (Relative to SEQ ID NO: 422)[1]				
521/522	V178I/F413Y	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/V178I/G183N/A256S/E270D/D272G/M302Q/F322A/Y371F/Q383E/Q394G/L412D/F413Y		++
523/524	V178I/G380R	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/V178I/G183N/A256S/E270D/D272G/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D		++
525/526	V178I/H448T	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/V178I/G183N/A256S/E270D/D272G/M302Q/F322A/Y371F/Q383E/Q394G/L412D/H448T		++
527/528	V178I/K246R/A338S	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/V178I/G183N/K246R/A256S/E270D/D272G/M302Q/F322A/A338S/Y371F/Q383E/Q394G/L412D		++
529/530	V178I/K258S/M286T/F413Y	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/V178I/G183N/A256S/K258S/E270D/D272G/M286T/M302Q/F322A/Y371F/Q383E/Q394G/L412D/F413Y	+	++
531/532	V178I/M286T	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/V178I/G183N/A256S/E270D/D272G/M286T/M302Q/F322A/Y371F/Q383E/Q394G/L412D		++
533/534	V178I/M286T/A338S/H448T	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/V178I/G183N/A256S/E270D/D272G/M286T/M302Q/F322A/A338S/Y371F/Q383E/Q394G/L412D/H448T		+++

Table 4-7. Alpha-Amylase Activity (Relative to SEQ ID NO: 422)[1]				
535/536	V178I/M286T/ A338S/P349R	E16D/E26A/D29R/D33E//K91H/A114H/ A122R/I128W/E130D/A145G/F157Y/K158R/V178I/G183N/A256S/E270D/D272G/M286T/M302Q/F322A/A338S/P349R/ Y371F/Q383E/Q394G/L412D		++
537/538	V178I/Q226T/ K258S/M286T/ Q310R/A338S	E16D/E26A/D29R/D33E/K91H/A114H/ A122R/I128W/E130D/A145G/F157Y/K158R/V178I/G183N/Q226T/A256S/K258S/E270D/D272G/M286T/M302Q/Q310R/F322A/A338S/Y371F/Q383E/Q394G/L412D		+++
539/540	V178I/Q226T/ M286T/A338S	E16D/E26A/D29R/D33E/K91H/A114H/ A122R/I128W/E130D/A145G/F157Y/K158R/V178I/G183N/Q226T/A256S/E270D/D272G/M286T/M302Q/F322A/A338S/Y371F/Q383E/Q394G/L412D		+++
[1]Levels of increased activity were determined relative to the reference polypeptide of SEQ ID NO: 422, and defined as follows: "+" > 0.9; "++" > 1.1; and "+++" > 1.5.				

[0247] Based on the results from **Table 4-7**, SEQ ID NO: 456 was chosen as the parent sequence for the next iteration of protein optimization. To generate new diversity, mutations from homologs were recombined using SEQ ID NO: 456, and variants with saturation mutagenesis at different positions were also constructed using this backbone. The variants were assayed in triplicate for amylase activity under unchallenged conditions at pH 6 and pH 7, and also at pH 6 after pre-incubation under two different conditions. The first condition was a 2 hour gastric challenge at pH 2.3, and the second condition was a 2 hour intestinal challenge, as described in Example 3. The results (relative to the results for SEQ ID NO: 456) are provided in **Table 4-8**. In some additional experiments, some variants were assayed in singlicate for amylase activity at pH 6 after a 2 hour gastric challenge at pH 2.3, as described in Example 3. The results (relative to the results for SEQ ID NO: 456) are provided in **Table 4-9**.

Table 4-8. Alpha-Amylase Activity (Relative to SEQ ID NO: 456)[1]

SEQ ID NO: (nt/aa)	Amino Acid Differences (Relative to SEQ ID NO: 456)	Amino Acid Differences (Relative to SEQ ID NO: 18)	Activity at pH 6 (Relative to SEQ ID NO: 456)	Activity at pH 7 (Relative to SEQ ID NO: 456)	Activity Post Intestinal Challenge (Relative to SEQ ID NO: 456)	Activity Post Gastric Challenge (Relative to SEQ ID NO: 456)
541/542	E134R	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/E134R/A145G/F157Y/K158R/G183N/K246R/A256S/E270D/D272G/M286T/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y	+	++		+++
543/544	H210P	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/H210P/K246R/A256S/E270D/D272G/M286T/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y			++	+++
545/546	S49A/S58T/Y141F/E298H	E16D/E26A/D29R/D33E/S49A/K91H/S58T/A114H/A122R/I128W/E130D/Y141F/A145G/F157Y/K158R/G183N/K246R/A256S/E270D/D272G/M286T/E298H/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y	++	++	+	+++
547/548	D279L	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/K246R/A256S/E270D/D272G/D279L/M286T/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y	++	++	++	+++
549/550	D123R	E16D/E26A/D29R/D33E/K91H/A114H/A122R/D123R/I128W/E130D/A145G/F157Y/K158R/G183N/K246R/A256S/E270D/D272G/M286T/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y	+	++		+++

Table 4-8. Alpha-Amylase Activity (Relative to SEQ ID NO: 456)[1]

551/552	P417W	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/K246R/A256S/E270D/D272G/M286T/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y/P417W	+	+	+	++
553/554	Q302H	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/K246R/A256S/E270D/D272G/M286T/M302H/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y	++	++	+	++
555/556	E214G	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/E214G/K246R/A256S/E270D/D272G/M286T/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y	+	++	+	++
557/558	P259C	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/K246R/A256S/P259C/E270D/D272G/M286T/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y	+	++	++	++
559/560	T126R	E16D/E26A/D29R/D33E/K91H/A114H/A122R/T126R/I128W/E130D/A145G/F157Y/K158R/G183N/K246R/A256S/E270D/D272G/M286T/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y	++	++		++
561/562	E131Y	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/E131Y/A145G/F157Y/K158R/G183N/K246R/A256S/E270D/D272G/M286T/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y	+	+		++

Table 4-8. Alpha-Amylase Activity (Relative to SEQ ID NO: 456)[1]

563/564	Q302W	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/K246R/A256S/E270D/D272G/M286T/M302W/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y	++	++	+	++
565/566	E393R	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/K246R/A256S/E270D/D272G/M286T/M302Q/F322A/Y371F/G380R/Q383E/E393R/Q394G/L412D/F413Y	+	+	+	++
567/568	D180E	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/D180E/G183N/K246R/A256S/E270D/D272G/M286T/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y	+	++	++	++
569/570	E131R	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/E131R/A145G/F157Y/K158R/G183N/K246R/A256S/E270D/D272G/M286T/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y				++
571/572	Q302R	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/K246R/A256S/E270D/D272G/M286T/M302R/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y	+	++	+	++
573/574	Q127W	E16D/E26A/D29R/D33E/K91H/A114H/A122R/Q127W/I128W/E130D/A145G/F157Y/K158R/G183N/K246R/A256S/E270D/D272G/M286T/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y	++	++		++

Table 4-8. Alpha-Amylase Activity (Relative to SEQ ID NO: 456)[1]

575/576	S49A/S58T/V103L/L194F/N204D/E298H	E16D/E26A/D29R/D33E/S49A/S58T/K91H/V103L/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/L194F/N204D/K246R/A256S/E270D/D272G/M286T/E298H/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y	+	++	++	++
577/578	D415C	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/K246R/A256S/E270D/D272G/M286T/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y/D415C	+	+		++
579/580	E282T	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/K246R/A256S/E270D/D272G/E282T/M286T/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y		+	+	++
581/582	E131H	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/E131H/A145G/F157Y/K158R/G183N/K246R/A256S/E270D/D272G/M286T/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y	+	++		++
583/584	Q228V	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/Q228V/K246R/A256S/E270D/D272G/M286T/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y	++	++	++	++
585/586	D428T	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/K246R/A256S/E270D/D272G/M286T/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y/D428T	++	++	++	++

Table 4-8. Alpha-Amylase Activity (Relative to SEQ ID NO: 456)[1]

587/588	S49A/S58T/V103L/Y141F/F197Y/H269F/M294H/E298Q	E16D/E26A/D29R/D33E/S49A/S58T/K91H/V103L/A114H/A122R/I128W/E130D/Y141F/A145G/F157Y/K158R/G183N/F197Y/K246R/A256S/H269F/E270D/D272G/M286T/M294H/E298Q/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y	+	++	+	++
589/590	R29E/F31L/R92A/Q394G	E16D/E26A/D29E/F31L/D33E/K91H/R92A/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/A220G/K246R/A256S/E270D/D272G/M286T/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y	+	+		++
591/592	A319S	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/K246R/A256S/E270D/D272G/M286T/M302Q/A319S/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y	+	+	+	++
593/594	Q466C	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/K246R/A256S/E270D/D272G/M286T/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y/Q466C	+	+	++	+
595/596	E429S	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/K246R/A256S/E270D/D272G/M286T/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y/E429S	++	+	+	+

Table 4-8. Alpha-Amylase Activity (Relative to SEQ ID NO: 456)[1]

597/598	R29E/V469I	E16D/E26A/D29E/D33E/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/K246R/A256S/E270D/D272G/M286T/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y/V469I	++	++	+	+
599/600	E393S	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/K246R/A256S/E270D/D272G/M286T/M302Q/F322A/Y371F/G380R/Q383E/Q394G/E393S/L412D/F413Y	++	++	++	+
601/602	V469I	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/K246R/A256S/E270D/D272G/M286T/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y/V469I	++	++	++	+
603/604	A220G/V469I	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/A220G/K246R/A256S/E270D/D272G/M286T/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y/V469I	+	++	+	
605/606	S49A/V103L	E16D/E26A/D29R/D33E/S49A/K91H/V103L/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/K246R/A256S/E270D/D272G/M286T/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y	++	++	++	
607/608	V103L	E16D/E26A/D29R/D33E/K91H/V103L/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/K246R/A256S/E270D/D272G/M286T/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y	++	++	+	

Table 4-8. Alpha-Amylase Activity (Relative to SEQ ID NO: 456)[1]

[1]Levels of increased activity were determined relative to the reference polypeptide of SEQ ID NO: 456, and defined as follows: "+" > 0.9; "++" > 1.1; and "+++" > 1.5.

Table 4-9. Alpha-Amylase Activity (Relative to SEQ ID NO: 456)[1]			
SEQ ID NO: (nt/aa)	**Amino Acid Differences (Relative to SEQ ID NO: 456)**	**Amino Acid Differences (Relative to SEQ ID NO: 18)**	**Amylase Activity Post gastric Challenge (Relative to SEQ ID NO: 456)**
541/542	E134R	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/E134R/A145G/F157Y/K158R/G183N/K246R/A256S/E270D/D272G/M286T/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y	++++
543/544	H210P	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/H210P/K246R/A256S/E270D/D272G/M286T/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y	+++
547/548	D279L	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/K246R/A256S/E270D/D272G/D279L/M286T/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y	++++
549/550	D123R	E16D/E26A/D29R/D33E/K91H/A114H/A122R/D123R/I128W/E130D/A145G/F157Y/K158R/G183N/K246R/A256S/E270D/D272G/M286T/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y	++++
551/552	P417W	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/K246R/A256S/E270D/D272G/M286T/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y/P417W	++
553/554	Q302H	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/K246R/A256S/E270D/D272G/M286T/M302H/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y	+++
555/556	E214G	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/E214G/K246R/A256S/E270D/D272G/M286T/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y	+++
557/558	P259C	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/K246R/A256S/P259C/E270D/D272G/M286T/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y	++

Table 4-9. Alpha-Amylase Activity (Relative to SEQ ID NO: 456)[1]			
559/560	T126R	E16D/E26A/D29R/D33E/K91H/A114H/A122R/T126R/I128W/E130D/A145G/F157Y/K158R/G183N/K246R/A256S/E270D/D272G/M286T/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y	+++
561/562	E131Y	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/E131Y/A145G/F157Y/K158R/G183N/K246R/A256S/E270D/D272G/M286T/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y	++++
563/564	Q302W	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/K246R/A256S/E270D/D272G/M286T/M302W/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y	+++
565/566	E393R	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/K246R/A256S/E270D/D272G/M286T/M302Q/F322A/Y371F/G380R/Q383E/E393R/Q394G/L412D/F413Y	+++
567/568	D180E	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/D180E/G183N/K246R/A256S/E270D/D272G/M286T/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y	+++
569/570	E131R	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/E131R/A145G/F157Y/K158R/G183N/K246R/A256S/E270D/D272G/M286T/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y	+++
571/572	Q302R	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/K246R/A256S/E270D/D272G/M286T/M302R/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y	+++
573/574	Q127W	E16D/E26A/D29R/D33E/K91H/A114H/A122R/Q127W/I128W/E130D/A145G/F157Y/K158R/G183N/K246R/A256S/E270D/D272G/M286T/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y	++++
577/578	D415C	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/K246R/A256S/E270D/D272G/M286T/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y/D415C	++

Table 4-9. Alpha-Amylase Activity (Relative to SEQ ID NO: 456)[1]			
579/580	E282T	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/K246R/A256S/E270D/D272G/E282T/M286T/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y	+++
581/582	E131H	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/E131H/A145G/F157Y/K158R/G183N/K246R/A256S/E270D/D272G/M286T/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y	+++
583/584	Q228V	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/Q228V/K246R/A256S/E270D/D272G/M286T/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y	++++
585/586	D428T	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/K246R/A256S/E270D/D272G/M286T/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y/D428T	+++
591/592	A319S	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/K246R/A256S/E270D/D272G/M286T/M302Q/A319S/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y	+++
593/594	Q466C	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/K246R/A256S/E270D/D272G/M286T/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y/Q466C	+++
595/596	E429S	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/K246R/A256S/E270D/D272G/M286T/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y/E429S	+++
599/600	E393S	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/K246R/A256S/E270D/D272G/M286T/M302Q/F322A/Y371F/G380R/Q383E/E393SQ394G/L412D/F413Y	+++
821/822	V409R	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/K246R/A256S/E270D/D272G/M286T/M302Q/F322A/Y371F/G380R/Q383E/Q394G/V409R/L412D/F413Y	++++

Table 4-9. Alpha-Amylase Activity (Relative to SEQ ID NO: 456)[1]			
823/824	A319L	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/K246R/A256S/E270D/D272G/M286T/M302Q/A319L/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y	++++
825/826	Y385L	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/K246R/A256S/E270D/D272G/M286T/M302Q/F322A/Y371F/G380R/Q383E/Y385L/Q394G/L412D/F413Y	++++
827/828	E451F	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/K246R/A256S/E270D/D272G/M286T/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y/E451F	++++
829/830	D180Q	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/D180Q/G183N/K246R/A256S/E270D/D272G/M286T/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y	++++
831/832	V409W	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/K246R/A256S/E270D/D272G/M286T/M302Q/F322A/Y371F/G380R/Q383E/Q394G/V409W/L412D/F413Y	++++
833/834	E282R	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/E282R/G183N/K246R/A256S/E270D/D272G/M286T/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y	+++
835/836	D172K	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/D172K/G183N/K246R/A256S/E270D/D272G/M286T/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y	+++
837/838	R221T	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/R221T/K246R/A256S/E270D/D272G/M286T/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y	+++
839/840	E492G	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/K246R/A256S/E270D/D272G/M286T/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y/E492G	+++

Table 4-9. Alpha-Amylase Activity (Relative to SEQ ID NO: 456)[1]			
841/842	V409A	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/K246R/A256S/E270D/D272G/M286T/M302Q/F322A/Y371F/G380R/Q383E/Q394G/V409A/L412D/F413Y	+++
843/844	Q127R	E16D/E26A/D29R/D33E/K91H/A114H/A122R/Q127R/I128W/E130D/A145G/F157Y/K158R/G183N/K246R/A256S/E270D/D272G/M286T/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y	+++
845/846	D279V	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/K246R/A256S/E270D/D272G/D279V/M286T/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y	+++
847/848	D415G	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/K246R/A256S/E270D/D272G/M286T/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y/D415G	+++
849/850	E444R	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/K246R/A256S/E270D/D272G/M286T/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y/E444R	+++
851/852	E393W	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/K246R/A256S/E270D/D272G/M286T/M302Q/F322A/Y371F/G380R/Q383E/E393W Q394G/L412D/F413Y	+++
853/854	I387V	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/K246R/A256S/E270D/D272G/M286T/M302Q/F322A/Y371F/G380R/Q383E/I387V/Q394G/L412D/F413Y	+++
855/856	D442W	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/K246R/A256S/E270D/D272G/M286T/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y/D442W	+++
857/858	R140V	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/R140V/A145G/F157Y/K158R/G183N/K246R/A256S/E270D/D272G/M286T/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y	+++

Table 4-9. Alpha-Amylase Activity (Relative to SEQ ID NO: 456)[1]			
859/860	V470L	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/K246R/A256S/E270D/D272G/M286T/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y/V470L	++
861/862	Q253R	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/K246R/Q253R/A256S/E270D/D272G/M286T/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y	++
863/864	R92G	E16D/E26A/D29R/D33E/K91H/R92G/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/K246R/A256S/E270D/D272G/M286T/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y	++
865/866	E467P	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/K246R/A256S/E270D/D272G/M286T/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y/E467P	++
867/868	N455T	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/K246R/A256S/E270D/D272G/M286T/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y/N455T	++
869/870	E214L	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/E214L/K246R/A256S/E270D/D272G/M286T/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y	++
871/872	E444G	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/K246R/A256S/E270D/D272G/M286T/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y/E444G	++
873/874	V470G	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/K246R/A256S/E270D/D272G/M286T/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y/V470G	++
875/876	V470S	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/K246R/A256S/E270D/D272G/M286T/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y/V470S	++

Table 4-9. Alpha-Amylase Activity (Relative to SEQ ID NO: 456)[1]			
877/878	D123G	E16D/E26A/D29R/D33E/K91H/A114H/A122R/D123G/I128W/E130D/A145G/F157Y/K158R/G183N/K246R/A256S/E270D/D272G/M286T/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y	++
879/880	E492R	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/K246R/A256S/E270D/D272G/M286T/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y/E492R	++
881/882	E444V	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/K246R/A256S/E270D/D272G/M286T/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y/E444V	++
883/884	D442R	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/K246R/A256S/E270D/D272G/M286T/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y/D442R	++
885/886	D305R	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/K246R/A256S/E270D/D272G/M286T/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y D305R	++
887/888	Q127I	E16D/E26A/D29R/D33E/K91H/A114H/A122R/Q127I/I128W/E130D/A145G/F157Y/K158R/G183N/K246R/A256S/E270D/D272G/M286T/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y	++
889/890	D305W	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/K246R/A256S/E270D/D272G/M286T/M302Q/D305W/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y	++
891/892	P259W	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/K246R/A256S/P259W/E270D/D272G/M286T/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y	++
893/894	E359G	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/K246R/A256S/E270D/D272G/M286T/M302Q/F322A/E359G/Y371F/G380R/Q383E/Q394G/L412D/F413Y	++

Table 4-9. Alpha-Amylase Activity (Relative to SEQ ID NO: 456)[1]			
895/896	D129W	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/D129W/E130D/A145G/F157Y/K158R/G183N/K246R/A256S/E270D/D272G/M286T/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y	++
897/898	D441R	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/K246R/A256S/E270D/D272G/M286T/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y/D441R	++
899/900	N455R	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/K246R/A256S/E270D/D272G/M286T/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y/N455R	++
901/902	E473M	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/K246R/A256S/E270D/D272G/M286T/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y/E473M	++
903/904	T446G	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/K246R/A256S/E270D/D272G/M286T/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y/T446G	++
905/906	D412A	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/K246R/A256S/E270D/D272G/M286T/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412A/F413Y	++
907/908	Q127V	E16D/E26A/D29R/D33E/K91H/A114H/A122R/Q127V/I128W/E130D/A145G/F157Y/K158R/G183N/K246R/A256S/E270D/D272G/M286T/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y	++
909/910	E214R	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/E214R/K246R/A256S/E270D/D272G/M286T/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y	++
911/912	D129C	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/D129C/E130D/A145G/F157Y/K158R/G183N/K246R/A256S/E270D/D272G/M286T/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y	++

Table 4-9. Alpha-Amylase Activity (Relative to SEQ ID NO: 456)[1]			
913/914	Q127S	E16D/E26A/D29R/D33E/K91H/A114H/A122R/Q127S/I128W/E130D/A145G/F157Y/K158R/G183N/K246R/A256S/E270D/D272G/M286T/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y	++
915/916	E134A	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/E134A/A145G/F157Y/K158R/G183N/K246R/A256S/E270D/D272G/M286T/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y	++
917/918	Q302V	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/K246R/A256S/E270D/D272G/M286T/M302V/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y	++
919/920	E467W	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/K246R/A256S/E270D/D272G/M286T/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y/E467W	++
921/922	N455L	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/K246R/A256S/E270D/D272G/M286T/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y/N455L	++
923/924	N474G	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/K246R/A256S/E270D/D272G/M286T/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y/N474G	++
925/926	D172R	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/D172R/G183N/K246R/A256S/E270D/D272G/M286T/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y	++
927/928	R304T	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/K246R/A256S/E270D/D272G/M286T/M302Q/R304T/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y	++
929/930	R92Q	E16D/E26A/D29R/D33E/K91H/R92Q/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/K246R/A256S/E270D/D272G/M286T/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y	++

Table 4-9. Alpha-Amylase Activity (Relative to SEQ ID NO: 456)[1]			
931/932	A322R	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/K246R/A256S/E270D/D272G/M286T/M302Q/F322R/Y371F/G380R/Q383E/Q394G/L412D/F413Y	++
933/934	E254G	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/K246R/E254G/A256S/E270D/D272G/M286T/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y	++
935/936	N455W	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/K246R/A256S/E270D/D272G/M286T/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y/N455W	++
937/938	D180P	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/D180P/G183N/K246R/A256S/E270D/D272G/M286T/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y	++
939/940	D441W	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/K246R/A256S/E270D/D272G/M286T/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y/D441W	++
941/942	R221V	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/R221V/K246R/A256S/E270D/D272G/M286T/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y	++
943/944	W346G	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/K246R/A256S/E270D/D272G/M286T/M302Q/F322A/W346G/Y371F/G380R/Q383E/Q394G/L412D/F413Y	++
945/946	I387G	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/K246R/A256S/E270D/D272G/M286T/M302Q/F322A/Y371F/G380R/Q383E/I387G/Q394G/L412D/F413Y	++
947/948	H210G	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/H210G/K246R/A256S/E270D/D272G/M286T/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y	++

Table 4-9. Alpha-Amylase Activity (Relative to SEQ ID NO: 456)[1]			
949/950	D123C	E16D/E26A/D29R/D33E/K91H/A114H/A122R/D123C/I128W/E130D/A145G/F157Y/K158R/G183N/K246R/A256S/E270D/D272G/M286T/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y	++
951/952	T384M	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/K246R/A256S/E270D/D272G/M286T/M302Q/F322A/Y371F/G380R/Q383E/T384M/Q394G/L412D/F413Y	++
953/954	T126Q	E16D/E26A/D29R/D33E/K91H/A114H/A122R/T126Q/I128W/E130D/A145G/F157Y/K158R/G183N/K246R/A256S/E270D/D272G/M286T/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y	++
955/956	E134F	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/E134F/A145G/F157Y/K158R/G183N/K246R/A256S/E270D/D272G/M286T/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y	++
957/958	V494C	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/K246R/A256S/E270D/D272G/M286T/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y/V494C	++
959/960	Q302G	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/K246R/A256S/E270D/D272G/M286T/M302G/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y	++
961/962	P259R	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/K246R/A256S/P259R/E270D/D272G/M286T/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y	++
963/964	R459W	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/K246R/A256S/E270D/D272G/M286T/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y/R459W	++
965/966	D305Q	E16D/E26A/D29R/D33E/K91H/A114H/A122R/I128W/E130D/A145G/F157Y/K158R/G183N/K246R/A256S/E270D/D272G/M286T/M302Q/D305Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y	++
[1]Levels of increased activity were determined relative to the reference polypeptide of SEQ ID NO: 456, and defined as follows: "+" > 0.9; "++" > 1.1; "+++" > 1.5; and "++++" > 2.5.			

[0248] Based on the results shown in **Table 4-8**, SEQ ID NO: 546 was chosen as the parent sequence for the next iteration of protein optimization. Beneficial mutations identified from **Table 4-9** were recombined into this backbone. The variants were assayed in triplicate for amylase activity for unchallenged activity at pH 6 and pH 7, as well as at pH 6 after pre-incubation under two different conditions. The first condition was a 2 hour gastric challenge at pH 2.3, and the second condition was a 2 hour intestinal challenge, as described in Example 3. The results (relative to the results for SEQ ID NO: 546) are provided in **Table 4-10**.

Table 4-10. Alpha-Amylase Activity (Relative to SEQ ID NO: 546)[1]						
SEQ ID NO: (nt/aa)	**Amino Acid Differences (Relative to SEQ ID NO: 546)**	**Amino Acid Differences (Relative to SEQ ID NO: 18)**	**Amylase Activity at pH 6 (Relative to SEQ ID NO: 546)**	**Amylase Activity at pH 7 (Relative to SEQ ID NO: 546)**	**Amylase Activity Post Intestinal Challenge (Relative to SEQ ID NO: 546)**	**Amylase Activity Post Gastric Challenge at pH 2.3 (Relative to SEQ ID NO: 546)**
609/610	T126R/H298Q/Q302R/E393R/D428T	E16D/E26A/D29R/D33E/S49A/K91H/S58T/A114H/A122R/T126R/I128W/E130D/Y141F/A145G/F157Y/K158R/G183N/K246R/A256S/E270D/D272G/M286T/E298Q/M302R/F322A/Y371F/G380R/Q383E/E393R/Q394G/L412D/F413Y/D428T	+	+		++
611/612	T126R/H210P/Q302R/D428T	E16D/E26A/D29R/D33E/S49A/K91H/S58T/A114H/A122R/T126R/I128W/E130D/Y141F/A145G/F157Y/K158R/G183N/H210P/K246R/A256S/E270D/D272G/M286T/E298H/M302R/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y/D428T	+	+		++
613/614	D129W	E16D/E26A/D29R/D33E/S49A/K91H/S58T/A114H/A122R/I128W/D129W/E130D/Y141F/A145G/F157Y/K158R/G183N/K246R/A256S/E270D/D272G/M286T/E298H/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y	+			+
615/616	T126R/H298Q/Q302H/E393R	E16D/E26A/D29R/D33E/S49A/K91H/S58T/A114H/A122R/T126R/I128W/E130D/Y141F/A145G/F157Y/K158R/G183N/K246R/A256S/E270D/D272G/M286T/E298Q/M302H/F322A/Y371F/G380R/Q383E/E393R/Q394G/L412D/F413Y	+	+		++

Table 4-10. Alpha-Amylase Activity (Relative to SEQ ID NO: 546)[1]

617/618	T126R/D180E/H298Q/Q302R/E393R	E16D/E26A/D29R/D33E/S49A/K91H/S58T/A114H/A122R/T126R/I128W/E130D/Y141F/A145G/F157Y/K158R/D180E/G183N/K246R/A256S/E270D/D272G/M286T/E298Q/M302R/F322A/Y371F/G380R/Q383E/E393R/Q394G/L412D/F413Y	+	+		+
619/620	D123R/T126R/H210P/H298Q/Q302W/E393R	E16D/E26A/D29R/D33E/S49A/K91H/S58T/A114H/A122R/D123R/T126R/I128W/E130D/Y141F/A145G/F157Y/K158R/G183N/H210P/K246R/A256S/E270D/D272G/M286T/E298Q/M302W/F322A/Y371F/G380R/Q383E/E393R/Q394G/L412D/F413Y	+			++
621/622	D123R/T126R/H210P/D428T	E16D/E26A/D29R/D33E/S49A/K91H/S58T/A114H/A122R/D123R/T126R/I128W/E130D/Y141F/A145G/F157Y/K158R/G183N/H210P/K246R/A256S/E270D/D272G/M286T/E298H/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y/D428T	+	+		++
623/624	D123R	E16D/E26A/D29R/D33E/S49A/K91H/S58T/A114H/A122R/D123R/I128W/E130D/Y141F/A145G/F157Y/K158R/G183N/K246R/A256S/E270D/D272G/M286T/E298H/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y	+	+		+
625/626	D123R/T126R/D428T	E16D/E26A/D29R/D33E/S49A/K91H/S58T/A114H/A122R/D123R/T126R/I128W/E130D/Y141F/A145G/F157Y/K158R/G183N/K246R/A256S/E270D/D272G/M286T/E298H/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y/D428T		+		++

Table 4-10. Alpha-Amylase Activity (Relative to SEQ ID NO: 546)[1]						
627/628	D123R/T126R/D180Q/E214G/E393R/D428T	E16D/E26A/D29R/D33E/S49A/K91H/S58T/A114H/A122R/D123R/T126R/I128W/E130D/Y141F/A145G/F157Y/K158R/D180Q/G183N/E214G/K246R/A256S/E270D/D272G/M286T/E298H/M302Q/F322A/Y371F/G380R/Q383E/E393R/Q394G/L412D/F413Y/D428T				++
629/630	D279L	E16D/E26A/D29R/D33E/S49A/K91H/S58T/A114H/A122R/I128W/E130D/Y141F/A145G/F157Y/K158R/G183N/K246R/A256S/E270D/D272G/D279L/M286T/E298H/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y				++
631/632	T126R/D180E/H210P/E214G/D428T	E16D/E26A/D29R/D33E/S49A/K91H/S58T/A114H/A122R/T126R/I128W/E130D/Y141F/A145G/F157Y/K158R/D180E/G183N/H210P/E214G/K246R/A256S/E270D/D272G/M286T/E298H/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y/D428T				++
633/634	T126R/E214G/E393R	E16D/E26A/D29R/D33E/S49A/K91H/S58T/A114H/A122R/T126R/I128W/E130D/Y141F/A145G/F157Y/K158R/G183N/E214G/K246R/A256S/E270D/D272G/M286T/E298H/M302Q/F322A/Y371F/G380R/Q383E/E393R/Q394G/L412D/F413Y		+		++
635/636	D123R/H210P/Q302R	E16D/E26A/D29R/D33E/S49A/K91H/S58T/A114H/A122R/D123R/I128W/E130D/Y141F/A145G/F157Y/K158R/G183N/H210P/K246R/A256S/E270D/D272G/M286T/E298H/M302R/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y				++

Table 4-10. Alpha-Amylase Activity (Relative to SEQ ID NO: 546)[1]

637/638	D129W/Q228V/Q253R	E16D/E26A/D29R/D33E/S49A/K91H/S58T/A114H/A122R/I128W/D129W/E130D/Y141F/A145G/F157Y/K158R/G183N/Q228V/K246R/Q253R/A256S/E270D/D272G/M286T/E298H/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y				++
639/640	T126R/D180Q/H210P/E214L/H298Q/Q302R	E16D/E26A/D29R/D33E/S49A/K91H/S58T/A114H/A122R/T126R/I128W/E130D/Y141F/A145G/F157Y/K158R/D180Q/G183N/H210P/E214L/K246R/A256S/E270D/D272G/M286T/E298Q/M302R/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y				++
641/642	Q228V/E282T/E244R	E16D/E26A/D29R/D33E/S49A/K91H/S58T/A114H/A122R/I128W/E130D/Y141F/A145G/F157Y/K158R/G183N/Q228V/K246R/A256S/E270D/D272G/E282T/M286T/E298H/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y/E444R				+++
643/644	D279L/V470S	E16D/E26A/D29R/D33E/S49A/K91H/S58T/A114H/A122R/I128W/E130D/Y141F/A145G/F157Y/K158R/G183N/K246R/A256S/E270D/D272G/D279L/M286T/E298H/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y/V470S			+	+++

Table 4-10. Alpha-Amylase Activity (Relative to SEQ ID NO: 546)[1]

645/646	D180Q/E214L	E16D/E26A/D29R/D33E/S49A/K91H/S58T/A114H/A122R/I128W/E130D/Y141F/A145G/F157Y/K158R/D180Q/G183N/E214L/K246R/A256S/E270D/D272G/M286T/E298H/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y				++
647/648	H210P/E214L/Q302R/D428T	E16D/E26A/D29R/D33E/S49A/K91H/S58T/A114H/A122R/I128W/E130D/Y141F/A145G/F157Y/K158R/G183N/H210P/E214L/K246R/A256S/E270D/D272G/M286T/E298H/M302R/F322A/Y371F/G380R/Q383E/E393R/Q394G/L412D/F413Y/D428T				++
649/650	E131Y/E282T	E16D/E26A/D29R/D33E/S49A/K91H/S58T/A114H/A122R/I128W/E130D/E131Y/Y141F/A145G/F157Y/K158R/G183N/K246R/A256S/E270D/D272G/E282T/M286T/E298H/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y				+++
651/652	D441R	E16D/E26A/D29R/D33E/S49A/K91H/S58T/A114H/A122R/I128W/E130D/Y141F/A145G/F157Y/K158R/G183N/K246R/A256S/E270D/D272G/M286T/E298H/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y/D441R				++
653/654	Q253R/D279V/V470S	E16D/E26A/D29R/D33E/S49A/K91H/S58T/A114H/A122R/I128W/E130D/Y141F/A145G/F157Y/K158R/G183N/K246R/Q253R/A256S/E270D/D272G/D279V/M286T/E298H/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y/V470S				++

Table 4-10. Alpha-Amylase Activity (Relative to SEQ ID NO: 546)[1]

655/656	Q253R/D279L/E492G	E16D/E26A/D29R/D33E/S49A/K91H/S58T/A114H/A122R/I128W/E130D/Y141F/A145G/F157Y/K158R/G183N/K246R/Q253R/A256S/E270D/D272G/D279L/M286T/E298H/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y/E492G				++
657/658	D123R/T126R/D180E/E214L/Q302W/E393R	E16D/E26A/D29R/D33E/S49A/S58T/K91H/A114H/A122R/D123R/T126R/I128W/E130D/Y141F/A145G/F157Y/K158R/D180E/G183N/E214L/K246R/A256S/E270D/D272G/M286T/E298Q/M302W/F322A/Y371F/G380R/Q383E/C/Q394G/L412D/F413Y				++
659/660	E131H/Q228V/D279V	E16D/E26A/D29R/D33E/S49A/S58T/K91H/A114H/A122R/I128W/E130D/E131H/Y141F/A145G/F157Y/K158R/G183N/Q228V/K246R/A256S/E270D/D272G/D279V/M286T/E298H/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y				++

[1]Levels of increased activity were determined relative to the reference polypeptide of SEQ ID NO: 546, and defined as follows: "+" > 0.9; "++" > 1.1; and "+++" > 1.5.

[0249] Based on the results shown in **Table 4-10**, SEQ ID NO: 632 was chosen as the parent sequence for the next iteration of protein optimization. To generate new diversity, mutations from homologs were recombined using the backbone. In addition, variants produced using saturation mutagenesis at different positions were also constructed on this backbone. The variants were assayed in triplicate for amylase activity for unchallenged activity at pH 6, and also after pre-incubation under two different conditions. The first condition was a 2 hour gastric challenge at pH 2.3, and the second condition was a 2 hour intestinal challenge, as described in Example 3. The results (relative to the results for SEQ ID NO: 632) are provided in **Table 4-11**.

Table 4-11. Alpha-Amylase Activity (Relative to SEQ ID NO: 632)[1]					
SEQ ID NO: (nt/aa)	**Amino Acid Differences (Relative to SEQ ID NO: 632)**	**Amino Acid Differences (Relative to SEQ ID NO: 18)**	**Amylase Activity at pH 6 (Relative to SEQ ID NO: 632)**	**Amylase activity Post Intestinal Challenge (Relative to SEQ ID NO: 632)**	**Amylase Activity Post Gastric Challenge (Relative to SEQ ID NO: 632)**
661/662	H165V	E16D/E26A/D29R/D33E/S49A/S58T/K91H/A114H/A122R/T126R/I128W/E130D/Y141F/A145G/F157Y/K158R/H165V/D180E/G183N/H210P/E214G/K246R/A256S/E270D/D272G/M286T/E298H/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y/D428T	++	+++	+
663/664	E184D/V223L/Y306F/M437L	E16D/E26A/D29R/D33E/S49A/S58T/K91H/A114H/A122R/T126R/I128W/E130D/Y141F/A145G/F157Y/K158R/D180E/G183N/E184D/H210P/E214G/V223L/K246R/A256S/E270D/D272G/M286T/E298H/M302Q/Y306F/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y/D428T/M437L	++	++	++
665/666	I166L/E203S	E16D/E26A/D29R/D33E/S49A/S58T/K91H/A114H/A122R/T126R/I128W/E130D/Y141F/A145G/F157Y/K158R/I166L/D180E/G183N/E203S/H210P/E214G/K246R/A256S/E270D/D272G/M286T/E298H/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y/D428T	++	++	
667/668	Y52R	E16D/E26A/D29R/D33E/S49A/Y52R/S58T/K91H/A114H/A122R/T126R/I128W/E130D/Y141F/A145G/F157Y/K158R/D180E/G183N/H210P/E214G/K246R/A256S/E270D/D272G/M286T/E298H/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y/D428T	++	++	++
669/670	E184D/I216L/Y306F/M308L	E16D/E26A/D29R/D33E/S49A/S58T/K91H/A114H/A122R/T126R/I128W/E130D/Y141F/A145G/F157Y/K158R/D180E/G183N/E184D/H210P/E214G/I216L/K246R/A256S/E270D/D272G/M286T/E298H/M302Q/Y306F/M308L/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y/D428T	++	++	+

Table 4-11. Alpha-Amylase Activity (Relative to SEQ ID NO: 632)[1]

671/672	D396E	E16D/E26A/D29R/D33E/S49A/S58T/K91H/A114H/A122R/T126R/I128W/E130D/Y141F/A145G/F157Y/K158R/D180E/G183N/H210P/E214G/K246R/A256S/E270D/D272G/M286T/E298H/M302Q/F322A/Y371F/G380R/Q383E/Q394G/D396E/L412D/F413Y/D428T	++	++	++
673/674	H114R/V223L/Y306F/M308L	E16D/E26A/D29R/D33E/S49A/S58T/K91H/A114R/A122R/T126R/I128W/E130D/Y141F/A145G/F157Y/K158R/D180E/G183N/H210P/E214G/V223L/K246R/A256S/E270D/D272G/M286T/E298H/M302Q/Y306F/M308L/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y/D428T	++	++	+
675/676	D396Q	E16D/E26A/D29R/D33E/S49A/S58T/K91H/A114H/A122R/T126R/I128W/E130D/Y141F/A145G/F157Y/K158R/D180E/G183N/H210P/E214G/K246R/A256S/E270D/D272G/M286T/E298H/M302Q/F322A/Y371F/G380R/Q383E/Q394G/D396Q/L412D/F413Y/D428T	++	++	++
677/678	A48D/I166L/D170S/E203S	E16D/E26A/D29R/D33E/A48D/S49A/S58T/K91H/A114H/A122R/T126R/I128W/E130D/Y141F/A145G/F157Y/K158R/I166L/D170S/D180E/G183N/E203S/H210P/E214G/K246R/A256S/E270D/D272G/M286T/E298H/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y/D428T	++	++	
679/680	H448P	E16D/E26A/D29R/D33E/S49A/S58T/K91H/A114H/A122R/T126R/I128W/E130D/Y141F/A145G/F157Y/K158R/D180E/G183N/H210P/E214G/K246R/A256S/E270D/D272G/M286T/E298H/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y/D428T/H448P	++	+	+
681/682	Y45S/I166L/H298D	E16D/E26A/D29R/D33E/Y45S/S49A/S58T/K91H/A114H/A122R/T126R/I128W/E130D/Y141F/A145G/F157Y/K158R/I166L/D180E/G183N/H210P/E214G/K246R/A256S/E270D/D272G/M286T/E298D/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y/D428T	++		

Table 4-11. Alpha-Amylase Activity (Relative to SEQ ID NO: 632)[1]

683/684	M294A	E16D/E26A/D29R/D33E/S49A/S58T/K91H/A114H/A122R/T126R/I128W/E130D/Y141F/A145G/F157Y/K158R/D180E/G183N/H210P/E214G/K246R/A256S/E270D/D272G/M286T/M294A/E298H/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y/D428T	++	++	++
685/686	V255M	E16D/E26A/D29R/D33E/S49A/S58T/K91H/A114H/A122R/T126R/I128W/E130D/Y141F/A145G/F157Y/K158R/D180E/G183N/H210P/E214G/K246R/V255M/A256S/E270D/D272G/M286T/E298H/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y/D428T	++	+	+
687/688	T58A/I166L	E16D/E26A/D29R/D33E/S49A/S58A/K91H/A114H/A122R/T126R/I128W/E130D/Y141F/A145G/F157Y/K158R/I166L/D180E/G183N/H210P/E214G/K246R/A256S/E270D/D272G/M286T/E298H/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y/D428T	++	+	
689/690	A48D	E16D/E26A/D29R/D33E/A48D/S49A/S58T/K91H/A114H/A122R/T126R/I128W/E130D/Y141F/A145G/F157Y/K158R/D180E/G183N/H210P/E214G/K246R/A256S/E270D/D272G/M286T/E298H/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y/D428T	++	++	
691/692	Q189D	E16D/E26A/D29R/D33E/S49A/S58T/K91H/A114H/A122R/T126R/I128W/E130D/Y141F/A145G/F157Y/K158R/D180E/G183N/Q189D/H210P/E214G/K246R/A256S/E270D/D272G/M286T/E298H/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y/D428T	++		
693/694	H114R	E16D/E26A/D29R/D33E/S49A/S58T/K91H/A114R/A122R/T126R/I128W/E130D/Y141F/A145G/F157Y/K158R/D180E/G183N/H210P/E214G/K246R/A256S/E270D/D272G/M286T/E298H/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y/D428T	++	++	+

Table 4-11. Alpha-Amylase Activity (Relative to SEQ ID NO: 632)[1]

695/696	Q82A	E16D/E26A/D29R/D33E/S49A/S58T/Q82A/K91H/A114H/A122R/T126R/I128W/E130D/Y141F/A145G/F157Y/K158R/D180E/G183N/H210P/E214G/K246R/A256S/E270D/D272G/M286T/E298H/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y/D428T	++	+	+
697/698	T58A/E203S	E16D/E26A/D29R/D33E/S49A/S58A/K91H/A114H/A122R/T126R/I128W/E130D/Y141F/A145G/F157Y/K158R/D180E/G183N/H210P/E214G/K246R/A256S/E270D/D272G/M286T/E298H/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y/D428T	++	++	
699/700	N482L	E16D/E26A/D29R/D33E/S49A/S58T/K91H/A114H/A122R/T126R/I128W/E130D/Y141F/A145G/F157Y/K158R/D180E/G183N/E203S/H210P/E214G/K246R/A256S/E270D/D272G/M286T/E298H/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y/D428T	++	+	+
701/702	S72T	E16D/E26A/D29R/D33E/S49A/S58T/S72T/K91H/A114H/A122R/T126R/I128W/E130D/Y141F/A145G/F157Y/K158R/D180E/G183N/H210P/E214G/K246R/A256S/E270D/D272G/M286T/E298H/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y/D428T	++	++	++
703/704	G483A	E16D/E26A/D29R/D33E/S49A/S58T/K91H/A114H/A122R/T126R/I128W/E130D/Y141F/A145G/F157Y/K158R/D180E/G183N/H210P/E214G/K246R/A256S/E270D/D272G/M286T/E298H/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y/D428T/G483A	++	+	++

Table 4-11. Alpha-Amylase Activity (Relative to SEQ ID NO: 632)[1]

705/706	E397M	E16D/E26A/D29R/D33E/S49A/S58T/K91H/A114H/A122R/T126R/I128W/E130D/Y141F/A145G/F157Y/K158R/D180E/G183N/H210P/E214G/K246R/A256S/E270D/D272G/M286T/E298H/M302Q/F322A/Y371F/G380R/Q383E/Q394G/E397M/L412D/F413Y/D428T	++	++	++
707/708	I495G	E16D/E26A/D29R/D33E/S49A/S58T/K91H/A114H/A122R/T126R/I128W/E130D/Y141F/A145G/F157Y/K158R/D180E/G183N/H210P/E214G/K246R/A256S/E270D/D272G/M286T/E298H/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y/D428T/I495G	++	+	
709/710	K258S	E16D/E26A/D29R/D33E/S49A/S58T/K91H/A114H/A122R/T126R/I128W/E130D/Y141F/A145G/F157Y/K158R/D180E/G183N/H210P/E214G/K246R/A256S/K258S/E270D/D272G/M286T/E298H/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y/D428T	+	+	
711/712	H298N	E16D/E26A/D29R/D33E/S49A/S58T/K91H/A114H/A122R/T126R/I128W/E130D/Y141F/A145G/F157Y/K158R/D180E/G183N/H210P/E214G/K246R/A256S/E270D/D272G/M286T/E298N/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y/D428T	+	++	++
713/714	I495L	E16D/E26A/D29R/D33E/S49A/S58T/K91H/A114H/A122R/T126R/I128W/E130D/Y141F/A145G/F157Y/K158R/D180E/G183N/H210P/E214G/K246R/A256S/E270D/D272G/M286T/E298H/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y/D428T/I495L	+	+	+
715/716	E203S	E16D/E26A/D29R/D33E/S49A/S58T/K91H/A114H/A122R/T126R/I128W/E130D/Y141F/A145G/F157Y/K158R/D180E/G183N/E203S/H210P/E214G/K246R/A256S/E270D/D272G/M286T/E298H/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y/D428T	+	++	

Table 4-11. Alpha-Amylase Activity (Relative to SEQ ID NO: 632)[1]

717/718	R468V	E16D/E26A/D29R/D33E/S49A/S58T/K91H/A114H/A122R/T126R/I128W/E130D/Y141F/A145G/F157Y/K158R/D180E/G183N/H210P/E214G/K246R/A256S/E270D/D272G/M286T/E298H/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y/D428T/R468V	+	++	++
719/720	Q275I	E16D/E26A/D29R/D33E/S49A/S58T/K91H/A114H/A122R/T126R/I128W/E130D/Y141F/A145G/F157Y/K158R/D180E/G183N/H210P/E214G/K246R/A256S/E270D/D272G/Q275I/M286T/E298H/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y/D428T	+	++	+
721/722	E167Y	E16D/E26A/D29R/D33E/S49A/S58T/K91H/A114H/A122R/T126R/I128W/E130D/Y141F/A145G/F157Y/K158R/E167Y/D180E/G183N/H210P/E214G/K246R/A256S/E270D/D272G/M286T/E298H/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y/D428T	+	++	+
723/724	Q149K	E16D/E26A/D29R/D33E/S49A/S58T/K91H/A114H/A122R/T126R/I128W/E130D/Y141F/A145G/Q149K/F157Y/K158R/D180E/G183N/H210P/E214G/K246R/A256S/E270D/D272G/M286T/E298H/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y/D428T	+	+	+
725/726	V255R	E16D/E26A/D29R/D33E/S49A/S58T/K91H/A114H/A122R/T126R/I128W/E130D/Y141F/A145G/F157Y/K158R/D180E/G183N/H210P/E214G/K246R/V255R/A256S/E270D/D272G/M286T/E298H/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y/D428T	+	+	+
727/728	K284M	E16D/E26A/D29R/D33E/S49A/S58T/K91H/A114H/A122R/T126R/I128W/E130D/Y141F/A145G/F157Y/K158R/D180E/G183N/H210P/E214G/K246R/K284M/A256S/E270D/D272G/M286T/E298H/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y/D428T	+	++	+

Table 4-11. Alpha-Amylase Activity (Relative to SEQ ID NO: 632)[1]

729/730	H298D	E16D/E26A/D29R/D33E/S49A/S58T/K91H/A114H/A122R/T126R/I128W/E130D/Y141F/A145G/F157Y/K158R/D180E/G183N/H210P/E214G/K246R/A256S/E270D/D272G/M286T/E298D/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y/D428T	+	+	+
731/732	D170S	E16D/E26A/D29R/D33E/S49A/S58T/K91H/A114H/A122R/T126R/I128W/E130D/Y141F/A145G/F157Y/K158R/D170S/D180E/G183N/H210P/E214G/K246R/A256S/E270D/D272G/M286T/E298H/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y/D428T	+	+	+
733/734	E225T	E16D/E26A/D29R/D33E/S49A/S58T/K91H/A114H/A122R/T126R/I128W/E130D/Y141F/A145G/F157Y/K158R/D180E/G183N/H210P/E214G/E225T/K246R/A256S/E270D/D272G/M286T/E298H/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y/D428T	+		+
735/736	T411E	E16D/E26A/D29R/D33E/S49A/S58T/K91H/A114H/A122R/T126R/I128W/E130D/Y141F/A145G/F157Y/K158R/D180E/G183N/H210P/E214G/K246R/A256S/E270D/D272G/M286T/E298H/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/T411E/F413Y/D428T	+	+	+
737/738	Q280C	E16D/E26A/D29R/D33E/S49A/S58T/K91H/A114H/A122R/T126R/I128W/E130D/Y141F/A145G/F157Y/K158R/D180E/G183N/H210P/E214G/K246R/A256S/E270D/D272G/Q280C/M286T/E298H/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y/D428T	+		++
739/740	Q275R	E16D/E26A/D29R/D33E/S49A/S58T/K91H/A114H/A122R/T126R/I128W/E130D/Y141F/A145G/F157Y/K158R/D180E/G183N/H210P/E214G/K246R/A256S/E270D/D272G/Q275R/M286T/E298H/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y/D428T	+	++	+

Table 4-11. Alpha-Amylase Activity (Relative to SEQ ID NO: 632)[1]

741/742	R2L	R2L/E16D/E26A/D29R/D33E/S49A/S58T/K91H/A114H/A122R/T126R/I128W/E130D/Y141F/A145G/F157Y/K158R/D180E/G183N/H210P/E214G/K246R/A256S/E270D/D272G/M286T/E298H/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y/D428T	+	+	+
743/744	K284L	E16D/E26A/D29R/D33E/S49A/S58T/K91H/A114H/A122R/T126R/I128W/E130D/Y141F/A145G/F157Y/K158R/D180E/G183N/H210P/E214G/K246R/A256S/E270D/D272G/K284L/M286T/E298H/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y/D428T	+	+	++
745/746	P431T	E16D/E26A/D29R/D33E/S49A/S58T/K91H/A114H/A122R/T126R/I128W/E130D/Y141F/A145G/F157Y/K158R/D180E/G183N/H210P/E214G/K246R/A256S/E270D/D272G/M286T/E298H/M302Q/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y/D428T/P431T		+	+

[1]Levels of increased activity were determined relative to the reference polypeptide of SEQ ID NO: 632, and defined as follows: "+" > 0.9; "++" > 1.1; and "+++" > 1.5.

[0250] Based on the results shown in **Table 4-11**, SEQ ID NO: 664 was chosen as the parent sequence for the next iteration of protein optimization. Mutations from homologs, and any other beneficial mutations identified from all the screening results not yet incorporated were recombined on this backbone. In addition, variants produced using saturation mutagenesis at different positions were also constructed on this backbone. The variants were assayed in triplicate for amylase activity for unchallenged activity at pH 6, and also after pre-incubation under two different conditions. The first condition was a 2 hour gastric challenge at pH 2.3, and the second condition was a 2 hour intestinal challenge, as described in Example 3. The results (relative to the results for SEQ ID NO: 664) are provided in **Table 4-12**.

[0251] In additional experiments, some of the variants from **Table 4-12** were also scaled up for production in shake flasks, and the purified enzymes were assayed for amylase activity for unchallenged activity at pH 6, and also after pre-incubations under two different conditions. The first condition was a 2 hour gastric challenge at pH 3, and the second condition was a 3 hour intestinal challenge, as described in Example 3. The results (relative to the results for SEQ ID NO: 664) are provided in **Table 4-13**.

Table 4-12. Alpha-Amylase Activity (Relative to SEQ ID NO: 664)[1]					
SEQ ID NO: (nt/aa)	**Amino Acid Differences (Relative to SEQ ID NO: 664)**	**Amino Acid Differences (Relative to SEQ ID NO: 18)**	**Amylase Activity at pH 6 (Relative to SEQ ID NO: 664)**	**Amylase Activity Post Intestinal Challenge (Relative to SEQ ID NO: 664)**	**Amylase Activity Post Gastric Challenge (Relative to SEQ ID NO: 664)**
747/748	D123E/F197Y/E225G/M294A/D396Q/H448Q/V469I	E16D/E26A/D29R/D33E/S49A/S58T/K91H/A114H/A122R/D123E/T126R/I128W/E130D/Y141F/A145G/F157Y/K158R/D180E/G183N/E184D/F197Y/H210P/E214G/V223L/E225G/K246R/A256S/E270D/D272G/M286T/M294A/E298H/M302Q/Y306F/F322A/Y371F/G380R/Q383E/Q394G/D396Q/L412D/F413Y/D428T/M437L/H448Q/V469I	++	++	++
749/750	H500P	E16D/E26A/D29R/D33E/S49A/S58T/K91H/A114H/A122R/T126R/I128W/E130D/Y141F/A145G/F157Y/K158R/D180E/G183N/E184D/H210P/E214G/V223L/K246R/A256S/E270D/D272G/M286T/E298H/M302Q/Y306F/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y/D428T/M437L/H500P	++	+	++
751/752	D123E/F197Y	E16D/E26A/D29R/D33E/S49A/S58T/K91H/A114H/A122R/D123E/T126R/I128W/E130D/Y141F/A145G/F157Y/K158R/D180E/G183N/E184D/F197Y/H210P/E214G/V223L/K246R/A256S/E270D/D272G/M286T/E298H/M302Q/Y306F/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y/D428T/M437L	++	++	++
753/754	I392C/H503L	E16D/E26A/D29R/D33E/S49A/S58T/K91H/A114H/A122R/T126R/I128W/E130D/Y141F/A145G/F157Y/K158R/D180E/G183N/E184D/H210P/E214G/V223L/K246R/A256S/E270D/D272G/M286T/E298H/M302Q/Y306F/F322A/Y371F/G380R/Q383E/I392C/Q394G/L412D/F413Y/D428T/M437L/H503L	++		
755/756	W458F	E16D/E26A/D29R/D33E/S49A/S58T/K91H/A114H/A122R/T126R/I128W/E130D/Y141F/A145G/F157Y/K158R/D180E/G183N/E184D/H210P/E214G/V223L/K246R/A256S/E270D/D272G/M286T/E298H/M302Q/Y306F/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y/D428T/M437L/W458F	+		+

Table 4-12. Alpha-Amylase Activity (Relative to SEQ ID NO: 664)[1]

757/758	L61Y	E16D/E26A/D29R/D33E/S49A/S58T/L61Y/K91H/A114H/A122R/T126R/I12 8W/E130D/Y141F/A145G/F157Y/K158R/D180E/G183N/E184D/H210P/E21 4G/V223L/K246R/A256S/E270D/D272G/M286T/E298H/M302Q/Y306F/F32 2A/Y371F/G380R/Q383E/Q394G/L412D/F413Y/D428T/M437L	+	+	+
759/760	E225G/M294A/H2 98N/D396Q	E16D/E26A/D29R/D33E/S49A/S58T/K91H/A114H/A122R/T126R/I128W/E 130D/Y141F/A145G/F157Y/K158R/D180E/G183N/E184D/H210P/E214G/ V223L/E225G/K246R/A256S/E270D/D272G/M286T/M294A/E298N/M302Q /Y306F/F322A/Y371F/G380R/Q383E/Q394G/D396Q/L412D/F413Y/D428T/ M437L	+	++	+
761/762	L41F	E16D/E26A/D29R/D33E/L41F/S49A/S58T/K91H/A114H/A122R/T126R/I12 8W/E130D/Y141F/A145G/F157Y/K158R/D180E/G183N/E184D/H210P/E21 4G/V223L/K246R/A256S/E270D/D272G/M286T/E298H/M302Q/Y306F/F32 2A/Y371F/G380R/Q383E/Q394G/L412D/F413Y/D428T/M437L	+		+
763/764	D123E/D170S/F19 7Y/Q275I/H298N/ D396Q/H448Q/G4 83Q	E16D/E26A/D29R/D33E/S49A/S58T/K91H/A114H/A122R/D123E/T126R/I1 28W/E130D/Y141F/A145G/F157Y/K158R/D170S/D180E/G183N/E184D/F1 97Y/H210P/E214G/V223L/K246R/A256S/E270D/D272G/Q275I/M286T/E29 8N/M302Q/Y306F/F322A/Y371F/G380R/Q383E/Q394G/D396Q/L412D/F41 3Y/D428T/M437L/H448Q/G483Q	+	++	+
765/766	W458Y	E16D/E26A/D29R/D33E/S49A/S58T/K91H/A114H/A122R/T126R/I128W/E 130D/Y141F/A145G/F157Y/K158R/D180E/G183N/E184D/H210P/E214G/V 223L/K246R/A256S/E270D/D272G/M286T/E298H/M302Q/Y306F/F322A/Y 371F/G380R/Q383E/Q394G/L412D/F413Y/D428T/M437L/W458Y	+	++	+

Table 4-12. Alpha-Amylase Activity (Relative to SEQ ID NO: 664)[1]

767/768	G499R	E16D/E26A/D29R/D33E/S49A/S58T/K91H/A114H/A122R/T126R/I128W/E130D/Y141F/A145G/F157Y/K158R/D180E/G183N/E184D/H210P/E214G/V223L/K246R/A256S/E270D/D272G/M286T/E298H/M302Q/Y306F/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y/D428T/M437L/G499R	+	+	+
769/770	D170S/Q275I/M294A/H298N/H448Q	E16D/E26A/D29R/D33E/S49A/S58T/K91H/A114H/A122R/T126R/I128W/E130D/Y141F/A145G/F157Y/K158R/D170S/D180E/G183N/E184D/H210P/E214G/V223L/K246R/A256S/E270D/D272G/Q275I/M286T/M294A/E298N/M302Q/Y306F/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y/D428T/M437L/H448Q	+	+	+
771/772	D123E/K284L/M294A/A324T/D396Q/H448Q	E16D/E26A/D29R/D33E/S49A/S58T/K91H/A114H/A122R/D123E/T126R/I128W/E130D/Y141F/A145G/F157Y/K158R/D180E/G183N/E184D/H210P/E214G/V223L/K246R/A256S/E270D/D272G/K284L/M286T/M294A/E298H/M302Q/Y306F/F322A/A324T/Y371F/G380R/Q383E/Q394G/D396Q/L412D/F413Y/D428T/M437L/H448Q	+	++	++
773/774	H165V/E225G/K284L/H298N/V469I/G483Q	E16D/E26A/D29R/D33E/S49A/S58T/K91H/A114H/A122R/T126R/I128W/E130D/Y141F/A145G/F157Y/K158R/H165V/D180E/G183N/E184D/H210P/E214G/V223L/E225G/K246R/A256S/E270D/D272G/K284L/M286T/E298N/M302Q/Y306F/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y/D428T/M437L/V469I/G483Q	+	++	+
775/776	I95V/I205V	E16D/E26A/D29R/D33E/S49A/S58T/K91H/I95V/A114H/A122R/T126R/I128W/E130D/Y141F/A145G/F157Y/K158R/D180E/G183N/E184D/I205V/H210P/E214G/V223L/K246R/A256S/E270D/D272G/M286T/E298H/M302Q/Y306F/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y/D428T/M437L	+		+

Table 4-12. Alpha-Amylase Activity (Relative to SEQ ID NO: 664)[1]

777/778	T227C	E16D/E26A/D29R/D33E/S49A/S58T/K91H/A114H/A122R/T126R/I128W/E130D/Y141F/A145G/F157Y/K158R/D180E/G183N/E184D/H210P/E214G/V223L/T227C/K246R/A256S/E270D/D272G/M286T/E298H/M302Q/Y306F/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y/D428T/M437L	+	+	++
779/780	I205V/D206E	E16D/E26A/D29R/D33E/S49A/S58T/K91H/A114H/A122R/T126R/I128W/E130D/Y141F/A145G/F157Y/K158R/D180E/G183N/E184D/I205V/D206E/H210P/E214G/V223L/K246R/A256S/E270D/D272G/M286T/E298H/M302Q/Y306F/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y/D428T/M437L	+	+	++
781/782	T58S/H500P/H501P	E16D/E26A/D29R/D33E/S49A/K91H/A114H/A122R/T126R/I128W/E130D/Y141F/A145G/F157Y/K158R/D180E/G183N/E184D/H210P/E214G/V223L/K246R/A256S/E270D/D272G/M286T/E298H/M302Q/Y306F/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y/D428T/M437L/H500P/H501P	+	++	+
783/784	I205V/D206E/M224L/T315S/W458F/F480L	E16D/E26A/D29R/D33E/S49A/S58T/K91H/A114H/A122R/T126R/I128W/E130D/Y141F/A145G/F157Y/K158R/D180E/G183N/E184D/I205V/D206E/H210P/E214G/V223L/M224L/K246R/A256S/E270D/D272G/M286T/E298H/M302Q/Y306F/T315S/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y/D428T/M437L/W458F/F480L			++
785/786	I95L/V252I/T285V/A324T	E16D/E26A/D29R/D33E/S49A/S58T/K91H/I95L/A114H/A122R/T126R/I128W/E130D/Y141F/A145G/F157Y/K158R/D180E/G183N/E184D/H210P/E214G/V223L/K246R/V252I/A256S/E270D/D272G/T285V/M286T/E298H/M302Q/Y306F/F322A/A324TY371F/G380R/Q383E/Q394G/L412D/F413Y/D428T/M437L			++

Table 4-12. Alpha-Amylase Activity (Relative to SEQ ID NO: 664)[1]					
787/788	I95V/L98I/T227V/S423V	E16D/E26A/D29R/D33E/S49A/S58T/K91H/I95V/L98I/A114H/A122R/T126R/I128W/E130D/Y141F/A145G/F157Y/K158R/D180E/G183N/E184D/H210P/E214G/V223L/T227V/K246R/A256S/E270D/D272G/M286T/E298H/M302Q/Y306F/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y/S423V/D428T/M437L			+
789/790	I95V/L98I/I205V/T227V/S423V/W458F	E16D/E26A/D29R/D33E/S49A/S58T/K91H/I95V/L98I/A114H/A122R/T126R/I128W/E130D/Y141F/A145G/F157Y/K158R/D180E/G183N/E184D/I205V/H210P/E214G/V223L/T227V/K246R/A256S/E270D/D272G/M286T/E298H/M302Q/Y306F/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y/S423V/D428T/M437L/W458F			++
791/792	D206E/T227V	E16D/E26A/D29R/D33E/S49A/S58T/K91H/A114H/A122R/T126R/I128W/E130D/Y141F/A145G/F157Y/K158R/D180E/G183N/E184D/D206E/H210P/E214G/V223L/T227V/K246R/A256S/E270D/D272G/M286T/E298H/M302Q/Y306F/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y/D428T/M437L		+	++
793/794	L6I/V39I/V103D/A324T/I420V	L6I/E16D/E26A/D29R/D33E/V39I/S49A/S58T/K91H/V103D/A114H/A122R/T126R/I128W/E130D/Y141F/A145G/F157Y/K158R/D180E/G183N/E184D/H210P/E214G/V223L/K246R/A256S/E270D/D272G/M286T/E298H/M302Q/Y306F/F322A/A324T/Y371F/G380R/Q383E/Q394G/L412D/F413Y/I420V/D428T/M437L			+
795/796	D206E/T227V/T315S/S423V	E16D/E26A/D29R/D33E/S49A/S58T/K91H/A114H/A122R/T126R/I128W/E130D/Y141F/A145G/F157Y/K158R/D180E/G183N/E184D/D206E/H210P/E214G/V223L/T227V/K246R/A256S/E270D/D272G/M286T/E298H/M302Q/Y306F/T315S/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y/S423V/D428T/M437L			++

Table 4-12. Alpha-Amylase Activity (Relative to SEQ ID NO: 664)[1]					
797/798	E134R/E225G/Q275I/Q302W	E16D/E26A/D29R/D33E/S49A/S58T/K91H/A114H/A122R/T126R/I128W/E130D/E134R/Y141F/A145G/F157Y/K158R/D180E/G183N/E184D/H210P/E214G/V223L/E225G/K246R/A256S/E270D/D272G/Q275I/M286T/E298H/M302W/Y306F/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y/D428T/M437L			++
[1]Levels of increased activity were determined relative to the reference polypeptide of SEQ ID NO: 664, and defined as follows: "+" > 0.9; and "++" > 1.1.					

Table 4-13. Alpha-Amylase Activity (Relative to SEQ ID NO: 664)[1]					
SEQ ID NO: (nt/aa)	**Amino Acid Differences (Relative to SEQ ID NO: 664)**	**Amino Acid Differences (Relative to SEQ ID NO: 18)**	**Amylase Activity at pH 6 (Relative to SEQ ID NO: 664)**	**Amylase Activity Post Gastric Challenge (Relative to SEQ ID NO: 664)**	**Amylase Activity Post Intestinal Challenge (Relative to SEQ ID NO: 664)**
797/798	E134R/E225G/Q275I/Q302W	E16D/E26A/D29R/D33E/S49A/S58T/K91H/A114H/A122R/T126R/I128W/E130D/E134R/Y141F/A145G/F157Y/K158R/D180E/G183N/E184D/H210P/E214G/V223L/E225G/K246R/A256S/E270D/D272G/Q275I/M286T/E298H/M302W/Y306F/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y/D428T/M437L	+	++	
747/748	D123E/F197Y/E225G/M294A/D396Q/H448Q/V469I	E16D/E26A/D29R/D33E/S49A/S58T/K91H/A114H/A122R/D123E/T126R/I128W/E130D/Y141F/A145G/F157Y/K158R/D180E/G183N/E184D/F197Y/H210P/E214G/V223L/E225G/K246R/A256S/E270D/D272G/M286T/M294A/E298H/M302Q/Y306F/F322A/Y371F/G380R/Q383E/Q394G/D396Q/L412D/F413Y/D428T/M437L/H448Q/V469I	+	++	+

Table 4-13. Alpha-Amylase Activity (Relative to SEQ ID NO: 664)[1]

751/752	D123E/F197Y	E16D/E26A/D29R/D33E/S49A/S58T/K91H/A114H/A122R/D123E/T126R/I128W/E130D/Y141F/A145G/F157Y/K158R/D180E/G183N/E184D/F197Y/H210P/E214G/V223L/K246R/A256S/E270D/D272G/M286T/E298H/M302Q/Y306F/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y/D428T/M437L	+	++	++
783/784	I205V/D206E/M224L/T315S/W458F/F480L	E16D/E26A/D29R/D33E/S49A/S58T/K91H/A114H/A122R/T126R/I128W/E130D/Y141F/A145G/F157Y/K158R/D180E/G183N/E184D/I205V/D206E/H210P/E214G/V223L/M224L/K246R/A256S/E270D/D272G/M286T/E298H/M302Q/Y306F/T315S/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y/D428T/M437L/W458F/F480L	+	++	
785/786	I95L/V252I/T285V/A324T	E16D/E26A/D29R/D33E/S49A/S58T/K91H/I95L/A114H/A122R/T126R/I128W/E130D/Y141F/A145G/F157Y/K158R/D180E/G183N/E184D/H210P/E214G/V223L/K246R/V252I/A256S/E270D/D272G/T285V/M286T/E298H/M302Q/Y306F/F322A/A324T/Y371F/G380R/Q383E/Q394G/L412D/F413Y/D428T/M437L	+	+	
779/780	I205V/D206E	E16D/E26A/D29R/D33E/S49A/S58T/K91H/A114H/A122R/T126R/I128W/E130D/Y141F/A145G/F157Y/K158R/D180E/G183N/E184D/I205V/D206E/H210P/E214G/V223L/K246R/A256S/E270D/D272G/M286T/E298H/M302Q/Y306F/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y/D428T/M437L	+	++	
663/664	-	-	+	+	+

[1]Levels of increased activity were determined relative to the reference polypeptide of SEQ ID NO: 664, and defined as follows: "+" >0.9; and "++" > 1.1.

[0252] Based on the results shown in **Table 4-10**, SEQ ID NO: 632 was found to have improved gastric stability, but lower intestinal stability compared to SEQ ID NO: 546. Sequence analysis identified a T126R substitution that may have caused the compromised intestinal stability. Based on the results from **Table 4-13**, SEQ ID NO: 780 was chosen as the parent sequence for the next iteration of protein optimization. An NNK library at position 126 was constructed using SEQ ID NO: 780, to rescue the loss of intestinal stability while maintaining gastric stability. The variants were assayed for amylase activity at pH 6 after pre-incubation under three different conditions. The first condition was a 2 hour gastric challenge at pH 2.3, the second condition was a 2 hour trypsin only challenge (no chymotrypsin), and the third condition was a 2 hour incubation with a protease (SEQ ID NO: 20), as described in Example 3. The results (relative to the results for SEQ ID NO: 780) are provided in **Table 4-14**.

Table 4-14. Alpha-Amylase Activity (Relative to SEQ ID NO: 780)[1]

SEQ ID NO: (nt/aa)	Amino Acid Differences (Relative to SEQ ID NO: 780)	Amino Acid Differences (Relative to SEQ ID NO: 18)	Amylase Activity Post Gastric Challenge (Relative to SEQ ID NO: 780)	Amylase Activity Post Intestinal Challenge (Relative to SEQ ID NO: 780)	Amylase Activity Post Protease Challenge (Relative to SEQ ID NO: 780)
799/800	R126N	E16D/E26A/D29R/D33E/S49A/S58T/K91H/A114H/A122R/T126N /I128W/E130D/Y141F/A145G/F157Y/K158R/D180E/G183N/E184 D/I205V/D206E/H210P/E214G/V223L/K246R/A256S/E270D/D27 2G/M286T/E298H/M302Q/Y306F/F322A/Y371F/G380R/Q383E/Q 394G/L412D/F413Y/D428T/M437L	+	++	+++
801/802	R126L	E16D/E26A/D29R/D33E/S49A/S58T/K91H/A114H/A122R/T126L/ I128W/E130D/Y141F/A145G/F157Y/K158R/D180E/G183N/E184 D/I205V/D206E/H210P/E214G/V223L/K246R/A256S/E270D/D27 2G/M286T/E298H/M302Q/Y306F/F322A/Y371F/G380R/Q383E/Q 394G/L412D/F413Y/D428T/M437L	+	+	++
803/804	R126Q	E16D/E26A/D29R/D33E/S49A/S58T/K91H/A114H/A122R/T126Q /I128W/E130D/Y141F/A145G/F157Y/K158R/D180E/G183N/E184 D/I205V/D206E/H210P/E214G/V223L/K246R/A256S/E270D/D27 2G/M286T/E298H/M302Q/Y306F/F322A/Y371F/G380R/Q383E/Q 394G/L412D/F413Y/D428T/M437L	+		++
805/806	R126K	E16D/E26A/D29R/D33E/S49A/S58T/K91H/A114H/A122R/T126K /I128W/E130D/Y141F/A145G/F157Y/K158R/D180E/G183N/E184 D/I205V/D206E/H210P/E214G/V223L/K246R/A256S/E270D/D27 2G/M286T/E298H/M302Q/Y306F/F322A/Y371F/G380R/Q383E/Q 394G/L412D/F413Y/D428T/M437L	+		

Table 4-14. Alpha-Amylase Activity (Relative to SEQ ID NO: 780)[1]

807/808	R126C	E16D/E26A/D29R/D33E/S49A/S58T/K91H/A114H/A122R/T126C/I128W/E130D/Y141F/A145G/F157Y/K158R/D180E/G183N/E184D/I205V/D206E/H210P/E214G/V223L/K246R/A256S/E270D/D272G/M286T/E298H/M302Q/Y306F/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y/D428T/M437L	+		++
809/810	R126T	E16D/E26A/D29R/D33E/S49A/S58T/K91H/A114H/A122R/T126T/I128W/E130D/Y141F/A145G/F157Y/K158R/D180E/G183N/E184D/I205V/D206E/H210P/E214G/V223L/K246R/A256S/E270D/D272G/M286T/E298H/M302Q/Y306F/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y/D428T/M437L		++	+++
811/812	R126S	E16D/E26A/D29R/D33E/S49A/S58T/K91H/A114H/A122R/T126S/I128W/E130D/Y141F/A145G/F157Y/K158R/D180E/G183N/E184D/I205V/D206E/H210P/E214G/V223L/K246R/A256S/E270D/D272G/M286T/E298H/M302Q/Y306F/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y/D428T/M437L			+
813/814	R126W	E16D/E26A/D29R/D33E/S49A/S58T/K91H/A114H/A122R/T126W/I128W/E130D/Y141F/A145G/F157Y/K158R/D180E/G183N/E184D/I205V/D206E/H210P/E214G/V223L/K246R/A256S/E270D/D272G/M286T/E298H/M302Q/Y306F/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y/D428T/M437L		++	++

Table 4-14. Alpha-Amylase Activity (Relative to SEQ ID NO: 780)[1]

815/816	R126M	E16D/E26A/D29R/D33E/S49A/S58T/K91H/A114H/A122R/T126M/I128W/E130D/Y141F/A145G/F157Y/K158R/D180E/G183N/E184D/I205V/D206E/H210P/E214G/V223L/K246R/A256S/E270D/D27 2G/M286T/E298H/M302Q/Y306F/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y/D428T/M437L		+	++
817/818	R126E	E16D/E26A/D29R/D33E/S49A/S58T/K91H/A114H/A122R/T126E/I128W/E130D/Y141F/A145G/F157Y/K158R/D180E/G183N/E184D/I205V/D206E/H210P/E214G/V223L/K246R/A256S/E270D/D27 2G/M286T/E298H/M302Q/Y306F/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y/D428T/M437L			++
819/820	R126D	E16D/E26A/D29R/D33E/S49A/S58T/K91H/A114H/A122R/T126D/I128W/E130D/Y141F/A145G/F157Y/K158R/D180E/G183N/E184D/I205V/D206E/H210P/E214G/V223L/K246R/A256S/E270D/D27 2G/M286T/E298H/M302Q/Y306F/F322A/Y371F/G380R/Q383E/Q394G/L412D/F413Y/D428T/M437L			++

[1]Levels of increased activity were determined relative to the reference polypeptide of SEQ ID NO: 780, and defined as follows: "+" > 0.9; "++" > 1.1; and "+++" > 1.5.

EXAMPLE 5: Comparison of Amylase Variant with and without His Tag

[0253] The C-terminus linker and His tag from SEQ ID NO: 810 was removed to generate SEQ ID NO: 1758. Both these variants were grown in HTP and were screened in duplicate for amylase activity at pH 6.8, activity post a 2 hour gastric challenge (1.5 mg/mL pepsin, pH 2.3), a 2 hour intestinal challenge, and a 2 hr protease challenge as described in Example 3. These two variants were found to have similar properties under the different conditions screened, as shown by the absorbance value in **Table 5**.

Table 5: Amylase activity comparisons between SEQ ID NO: 810 and SEQ ID NO: 1758[1]

SEQ ID NO: (nt/aa)	Activity (A405)	Activity Post Gastric Challenge (A405)	Activity Post Intestinal Protease Challenge (A405)	Activity Post Protease Challenge (A405)
809/810	4.1±0.1	3.2±0.2	3.3±0.1	3.6±0.1
1757/1758	4.2±0.1	3.4±0.1	3.6±0.2	3.6±0.1

[1]Levels of activity are expressed as absorbance units ± standard deviation at 405nm

[0254] All publications, patents, patent applications and other documents cited in this application are hereby incorporated by reference in their entireties for all purposes to the same extent as if each individual publication, patent, patent application or other document were individually indicated to be incorporated by reference for all purposes.

[0255] While various specific embodiments have been illustrated and described, it will be appreciated that various changes can be made without departing from the spirit and scope of the invention.

CLAIMS

WHAT IS CLAIMED IS:

1. A recombinant amylase comprising an amino acid sequence comprising at least 70%, at least 75%, at least 80%, at least 85%, at least 90%, at least 91%, at least 92%, at least 93%, at least 94%, at least 95%, at least 96%, at least 97%, at least 98%, or at least 99% sequence identity to SEQ ID NO: 2.

2. The recombinant amylase of Claim 1, wherein said recombinant amylase comprises a polypeptide sequence having at least 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99%, or more sequence identity to SEQ ID NO: 18, 40, 156, 174, 276, 308, 422, 456, 546, 632, 664, 780, 988, 1104, 1122, 1224, 1256, 1370, 1404, 1494, 1580, 1612, and/or 1728.

3. The recombinant amylase of Claim 1 or 2, wherein the polypeptide sequence further comprises one or more substitutions relative to the sequence of (a) SEQ ID NO: 2, or (b) SEQ ID NO: 18, 40, 156, 174, 276, 308, 422, 456, 546, 632, 664, 780, 988, 1104, 1122, 1224, 1256, 1370, 1404, 1494, 1580, 1612, or 1728

4. The recombinant amylase of Claim 1, wherein said recombinant amylase comprises a polypeptide sequence having at least 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99%, or more sequence identity to SEQ ID NO: 2 or 18, or a functional fragment thereof, and wherein the recombinant amylase comprises one or more substitutions at positions selected from 16, 26, 29, 33, 91, 114,157, 158, 180, 184, 214, 223, 256, 272, 298, 302, 371, 380, 383, 394 412, 428, and 437, wherein the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 2 or 18.

5. The recombinant amylase of Claim 1, the recombinant amylase comprises a polypeptide sequence having at least 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99%, or more sequence identity to SEQ ID NO: 2 or 18, or a functional fragment thereof, and wherein the recombinant amylase comprises one or more substitutions selected from 16D, 26A, 29G, 29R, 29S, 29A, 29E, 33E, 91H, 114H, 157Y, 158R, 180E, 180Q, 184D, 184K, 214G, 223L, 256T, 272G, 272K, 272P, 272R, 272S, 298H, 302Q, 302G, 302H, 302R, 302V, 302W, 371F, 380R, 383E, 383I, 394N, 394S, 394G, 412A, 412L, 412D, 412S, 428T, and 437L, wherein the amino acid positions of the polypeptide sequence are numbered with reference to SEQ ID NO: 2 or 18.

6. The recombinant amylase of Claim 1, wherein said recombinant amylase comprises a polypeptide sequence having at least 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99%, or more sequence identity to SEQ ID NO: 2 or 18, wherein said recombinant

amylase comprises at least one substitution or substitution set at one or more positions selected from 2/73/256/493, 16/33/73/130/256/282/371/374/493, 16/33/130/256/302/371/383/470, 16/33/157/256/302/371/383, 16/73/74/256/282/366/371/383/493, 16/73/256/282/302/331/371/383, 16/130/256/276/374/470, 16/256/302/374, 19/72/345/473, 26/27/396/412/428/473, 26/27/412, 26/27/466/473, 29, 73/130/256/282/302/493, 74/371/374/383/493, 130/256/493, 149, 158, 254, 256, 256/383, 257, 259, 272, 279, 284, 317/383, 322, 345/388/396/428, 388/396/412/428, 396/412, 396/412/428/466, 409, 412, and 495, wherein the amino acid positions of said polypeptide sequence are numbered with reference to SEQ ID NO: 2 or 18.

7. The recombinant amylase of Claim 1, wherein said recombinant amylase comprises a polypeptide sequence having at least 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99%, or more sequence identity to SEQ ID NO: 40 or 988, wherein said recombinant amylase comprises at least one substitution or substitution set at one or more positions selected from 26/29/158/272/412, 26/29/272/279/412/493, 26/29/272/396/412, 26/29/279/412/428, 26/158/272/279/388/412/428, 26/158/272/412, 26/272/279/412/428/493, 29/272/279/396/412, 130/149/254/284/322/409/495, 130/149/257/284/322/409/466/473, 130/254/284/322/374/409/466, 130/257/284/374/409/466, 130/284/322/374/409/473, 149/257/284/322/409/466, 158/272/279/394/396/412/428/493, 158/272/388/412/428/493, 158/272/412/428, 158/279/388/396/412/428, 254/257/284/322/409/473, 254/284/409/466/495, 272/279/412/428/493, 272/412/428, 272/412/493, and 284/322/409/473, wherein the amino acid positions of said polypeptide sequence are numbered with reference to SEQ ID NO: 40 or 988.

8. The recombinant amylase of Claim 1, wherein said recombinant amylase comprises a polypeptide sequence having at least 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99%, or more sequence identity to SEQ ID NO: 156 or 1104, wherein said recombinant amylase comprises at least one substitution or substitution set at one or more positions selected from 37, 51, 91, 111, 112, 114, 122, 124, 128, 140, 167, 171, 183, 194, 276, 280, 298, 397, and 464, wherein the amino acid positions of said polypeptide sequence are numbered with reference to SEQ ID NO: 156 or 1104.

9. The recombinant amylase of Claim 1, wherein said recombinant amylase comprises a polypeptide sequence having at least 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99%, or more sequence identity to SEQ ID NO: 174 or 1122, wherein said recombinant amylase comprises at least one substitution or substitution set at one or more positions selected from 24, 91, 91/122, 91/122/128/130/167/171/409, 91/122/128/130/183/322, 91/122/128/130/194, 91/122/128/130/322, 91/122/128/171/183/194/322, 91/122/128/183/409, 91/122/130/167/183/194/409, 91/122/130/171/183, 91/122/130/183/194, 91/122/130/194, 91/122/130/194/322, 91/122/167/171/194, 91/122/167/171/194/322, 91/122/171/183/194/409,

91/130/171/183/322/409, 91/167/171, 91/167/183/194, 91/167/322, 91/183, 91/183/322/409, 91/194, 91/322, 91/409, 122/128, 122/128/194/409, 122/130/171/322/409, 122/409, 137/145/227/394/480/481, 137/145/295, 145/227/295/481, 145/309/481, 183, 227, 295/394, 322, 322/409, 394, and 480/481, wherein the amino acid positions of said polypeptide sequence are numbered with reference to SEQ ID NO: 174 or 1122.

10. The recombinant amylase of Claim 1, wherein said recombinant amylase comprises a polypeptide sequence having at least 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99%, or more sequence identity to SEQ ID NO:276 or 1224, wherein said recombinant amylase comprises at least one substitution or substitution set at one or more positions selected from 16/26/29/128/145/256/309/383, 16/26/33/114/145/309/383/394, 16/26/33/128/130/145/302/309/322/371, 16/26/33/145/158/383/394, 16/26/145/302, 16/29/33/145/256/302, 18, 26/29/33/130/145/157/158/183/394, 26/29/33/145/157/183/256/309/383, 26/29/122/130/145/183/256/272/309/394, 26/29/145/157/256/302/322/481, 26/29/145/256/272/302/309/322/481, 26/33/91/145/272/302/481, 26/33/145/309/322/383, 26/114/145/322, 26/145/183/256/309/383, 29/122/145/158/383, 29/130/145/256/272/371/394, 29/145/183/302/309/412, 29/309/394, 33/122/145/272/309/412, 91/130/145/158/183/383, 91/309/383, 130/145/256/272/371, 130/145/302/309, 130/272/481, 145/302/309, 268, 309, 349, 360, 380, 394, 463, and 483, wherein the amino acid positions of said polypeptide sequence are numbered with reference to SEQ ID NO: 276 or 1224.

11. The recombinant amylase of Claim 1, wherein said recombinant amylase comprises a polypeptide sequence having at least 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99%, or more sequence identity to SEQ ID NO: 308 or 1256, wherein said recombinant amylase comprises at least one substitution or substitution set at one or more positions selected from 29, 37/124/250/270/349/380/394/442/491, 37/145, 37/145/250/301/349/394, 37/145/258/442/491, 38/349/491, 81/259, 81/313/495, 92/257/258/338/468, 92/258, 94/127/132/145/250/349, 94/270/301/349/394/442, 94/349/491, 145/270, 178, 225, 226, 246, 250/349/442, 259/313/338, 270/349, 286/338, 294, 313, 349, 349/380/442, 413, 413/468, 448, and 473, wherein the amino acid positions of said polypeptide sequence are numbered with reference to SEQ ID NO: 308 or 1256.

12. The recombinant amylase of Claim 1, wherein said recombinant amylase comprises a polypeptide sequence having at least 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99%, or more sequence identity to SEQ ID NO: 422 or 1370, wherein said recombinant amylase comprises at least one substitution or substitution set at one or more positions selected from 38, 38/178/226/286/338, 38/178/286/448, 38/178/349/448, 38/226/246/258/286, 38/226/258/286/338/380/448, 38/226/258/349/413, 38/226/286, 38/226/286/338/380,

38/226/338/349/380, 38/226/413/448, 38/246/286, 38/246/286/380, 38/258, 38/286, 38/286/413/448, 38/286/448, 38/448, 178, 178/226/258/286/310/338, 178/226/286/338, 178/246/338, 178/258/286/413, 178/286, 178/286/338/349, 178/286/338/448, 178/380, 178/413, 178/448, 184/246/258/380, 226, 226/246/286/349/448, 226/246/413, 226/258/286/349/380, 226/258/286/413/448, 226/286, 226/286/380/448, 226/349/380, 246, 246/286, 246/286/380/413, 246/338, 246/413, 258/286/413, 286, 286/413/448, 338/448, 349, and 413, wherein the amino acid positions of said polypeptide sequence are numbered with reference to SEQ ID NO: 422 or 1370.

13. The recombinant amylase of Claim 1, wherein said recombinant amylase comprises a polypeptide sequence having at least 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99%, or more sequence identity to SEQ ID NO: 456 or 1404, wherein said recombinant amylase comprises at least one substitution or substitution set at one or more positions selected from 29/31/92/220, 29/469, 49/58/103/141/197/269/294/298, 49/58/103/194/204/298, 49/58/141/298, 49/103, 103, 123, 126, 127, 131, 134, 180, 210, 214, 220/469, 228, 259, 279, 282, 302, 319, 393, 415, 417, 428, 429, 466, and 469, wherein the amino acid positions of said polypeptide sequence are numbered with reference to SEQ ID NO: 456 or 1404.

14. The recombinant amylase of Claim 1, wherein said recombinant amylase comprises a polypeptide sequence having at least 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99%, or more sequence identity to SEQ ID NO: 456 or 1404, wherein said recombinant amylase comprises at least one substitution or substitution set at one or more positions selected from 92, 123, 126, 127, 129, 131, 134, 140, 172, 180, 210, 214, 221, 228, 253, 254, 259, 279, 282, 302, 304, 305, 319, 322, 346, 359, 384, 385, 387, 393, 409, 412, 415, 417, 428, 429, 441, 442, 444, 446, 451, 455, 459, 466, 467, 470, 473, 474, 492, and 494, wherein the amino acid positions of said polypeptide sequence are numbered with reference to SEQ ID NO: 456 or 1404.

15. The recombinant amylase of Claim 1, wherein said recombinant amylase comprises a polypeptide sequence having at least 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99%, or more sequence identity to SEQ ID NO: 546 or 1494, wherein said recombinant amylase comprises at least one substitution or substitution set at one or more positions selected from 123, 123/126/180/214/298/302/393, 123/126/180/214/393/428, 123/126/210/298/302/393, 123/126/210/428, 123/126/428, 123/210/302, 126/180/210/214/298/302, 126/180/210/214/428, 126/180/298/302/393, 126/210/302/428, 126/214/393, 126/298/302/393, 126/298/302/393/428, 129, 129/228/253, 131/228/279, 131/282, 180/214, 210/214/302/393/428, 228/282/444, 253/279/470, 253/279/492, 279, 279/470, and 441, wherein the amino acid positions of said polypeptide sequence are numbered with reference to SEQ ID NO: 546 or 1494.

16. The recombinant amylase of Claim 1, wherein said recombinant amylase comprises a polypeptide sequence having at least 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99%, or more sequence identity to SEQ ID NO: 632 or 1580, wherein said recombinant amylase comprises at least one substitution or substitution set at one or more positions selected from 2, 45/166/298, 48, 48/166/170/203, 52, 58/166, 58/203, 72, 82, 114, 114/223/306/308, 149, 165, 166/203, 167, 170, 184/216/306/308, 184/223/306/437, 189, 203, 225, 255, 258, 275, 280, 284, 294, 298, 396, 397, 411, 431, 448, 468, 482, 483, and 495, wherein the amino acid positions of said polypeptide sequence are numbered with reference to SEQ ID NO: 632 or 1580.

17. The recombinant amylase of Claim 1, wherein said recombinant amylase comprises a polypeptide sequence having at least 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99%, or more sequence identity to SEQ ID NO: 664 or 1612, wherein said recombinant amylase comprises at least one substitution or substitution set at one or more positions selected from 6/39/103/324/420, 41, 58/500/501, 61, 95/98/205/227/423/458, 95/98/227/423, 95/205, 95/252/285/324, 123/170/197/275/298/396/448/483, 123/197, 123/197/225/294/396/448/469, 123/284/294/324/396/448, 134/225/275/302, 165/225/284/298/469/483, 170/275/294/298/448, 205/206, 205/206/224/315/458/480, 206/227, 206/227/315/423, 225/294/298/396, 227, 392/503, 458, 499, and 500, wherein the amino acid positions of said polypeptide sequence are numbered with reference to SEQ ID NO: 664 or 1612.

18. The recombinant amylase of Claim 1, wherein said recombinant amylase comprises a polypeptide sequence having at least 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99%, or more sequence identity to SEQ ID NO: 664 or 1612, wherein said recombinant amylase comprises at least one substitution or substitution set at one or more positions selected from 95/252/285/324, 123/197, 123/197/225/294/396/448/469, 134/225/275/302, 205/206, and 205/206/224/315/458/480, wherein the amino acid positions of said polypeptide sequence are numbered with reference to SEQ ID NO: 664 or 1612.

19. The recombinant amylase of Claim 1, wherein said recombinant amylase comprises a polypeptide sequence having at least 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99%, or more sequence identity to SEQ ID NO: 780 or 1728, wherein said recombinant amylase comprises at least one substitution or substitution set at position 126, wherein the amino acid positions of said polypeptide sequence are numbered with reference to SEQ ID NO: 780 or 1728.

20. The recombinant amylase of Claim 1, wherein said recombinant amylase comprises at least one mutation in at least one position as provided in Table 4-1, 4-2, 4-3, 4-4, 4-5, 4-6, 4-7, 4-8, 4-9, 4-10, 4-11, 4-12, 4-13, and/or 4-14, wherein the positions are numbered with reference to SEQ

ID NO: 2, 18, 40, 156, 174, 276, 308, 422, 456, 546, 632, 664, 780, 988, 1104, 1122, 1224, 1256, 1370, 1404, 1494, 1580, 1612, and/or 1728.

21. The recombinant amylase of Claim 1, comprising a polypeptide sequence selected from even-numbered sequences of SEQ ID NOS: 4-18, 22-966, and 970-1914.

22. The recombinant amylase of Claim 1, comprising a polypeptide sequence selected from even-numbered sequences of SEQ ID NOS: 970-1914.

23. The recombinant amylase of Claim 1, comprising a polypeptide sequence selected from even-numbered sequences of SEQ ID NOS: 800-820 and 1748-1768.

24. The recombinant amylase of Claim 1, comprising a polypeptide sequence selected from SEQ ID NOS: 40, 156, 174, 276, 308, 422, 456, 546, 632, 664, 780, 810, 988, 1104, 1122, 1224, 1256, 1370, 1404, 1494, 1580, 1612, 1728, and 1758.

25. The recombinant amylase of any of Claims 1-24, wherein said recombinant amylase is more thermostable than the amylase of SEQ ID NO: 2, 18, 40, 156, 174, 276, 308, 422, 456, 546, 632, 664, 780, 988, 1104, 1122, 1224, 1256, 1370, 1404, 1494, 1580, 1612, and/or 1728.

26. The recombinant amylase of any of Claims 1-25, wherein said recombinant amylase is more stable under acidic pH conditions than the amylase of SEQ ID NO: 2, 18, 40, 156, 174, 276, 308, 422, 456, 546, 632, 664, 780, 988, 1104, 1122, 1224, 1256, 1370, 1404, 1494, 1580, 1612, and/or 1728.

27. The recombinant amylase of any of Claims 1-26, wherein said recombinant amylase is more active at pH 6, than the amylase of SEQ ID NO: 2, 18, 40, 156, 174, 276, 308, 422, 456, 546, 632, 664, 780, 988, 1104, 1122, 1224, 1256, 1370, 1404, 1494, 1580, 1612, and/or 1728.

28. The recombinant amylase of any of Claims 1-27, wherein said recombinant amylase is more resistant to proteolysis than the amylase of SEQ ID NO: 2, 18, 40, 156, 174, 276, 308, 422, 456, 546, 632, 664, 780, 988, 1104, 1122, 1224, 1256, 1370, 1404, 1494, 1580, 1612, and/or 1728.

29. The recombinant amylase of any of Claims 1-28, wherein said recombinant amylase is more active in the presence of at least one bile salt than the amylase of SEQ ID NO: 2, 18, 40, 156, 174, 276, 308, 422, 456, 546, 632, 664, 780, 988, 1104, 1122, 1224, 1256, 1370, 1404, 1494, 1580, 1612, and/or 1728.

30. The recombinant amylase of any of Claims 1-29, wherein said recombinant amylase is purified.

31. The recombinant amylase of any of Claims 1-30, wherein said recombinant amylase exhibits at least one improved property selected from: i) enhanced catalytic activity; ii) increased tolerance to acidic pH conditions; iii) increased tolerance to at least one protease; iv) increased tolerance to at least one bile salt; v) increased thermotolerance; or a combination of any of i), ii), iii), iv), and v), as compared to a reference sequence.

32. The recombinant amylase of Claim 31, wherein said reference sequence is SEQ ID NO: 2.

33. The recombinant amylase of Claim 31, wherein said reference sequence is selected from SEQ ID NO: 18, 40, 156, 174, 276, 308, 422, 456, 546, 632, 664, 780, 988, 1104, 1122, 1224, 1256, 1370, 1404, 1494, 1580, 1612, and 1728.

34. A composition comprising at least one recombinant amylase of any of Claims 1-33.

35. A recombinant polynucleotide sequence encoding at least one recombinant amylase set forth in any of Claims 1-33.

36. The recombinant polynucleotide sequence of Claim 35, wherein said polynucleotide sequence is codon-optimized.

37. An expression vector comprising at least one recombinant polynucleotide sequence of Claim 35 and/or 36.

38. The expression vector of Claim 37, wherein said recombinant polynucleotide sequence is operably linked to a control sequence.

39. The expression vector of Claim 37 or 38, wherein said control sequence is a promoter.

40. The expression vector of Claim 39, wherein said promoter is a heterologous promoter.

41. A host cell comprising the expression vector of any of Claims 37-40.

42. The host cell of Claim 41, wherein said host cell is eukaryotic or prokaryotic.

43. A method of producing a recombinant amylase, comprising culturing said host cell of Claim 41 or 42, under conditions that said recombinant amylase encoded by said recombinant polynucleotide is produced.

44. The method of Claim 43, further comprising the step of recovering said amylase.

45. The method of Claim 44, further comprising the step of purifying said amylase.

46. A pharmaceutical composition for the treatment of pancreatic insufficiency, comprising the composition of Claim 34.

47. The pharmaceutical composition of Claim 46, further comprising a pharmaceutically acceptable carrier and/or excipient.

48. The pharmaceutical composition of Claim 46 and/or 47, wherein said composition further comprises at least one protease.

49. The pharmaceutical composition of any of Claims 46-48, wherein said composition further comprises at least one lipase.

50. The pharmaceutical composition of Claim 46 and/or 47, wherein said composition further comprises at least one lipase and at least one protease.

51. The composition of any of Claims 34, and 46-50, further comprising a pancreatic extract, wherein said pancreatic extract comprises lipase, protease, and amylase activity.

52. The pharmaceutical composition of any of Claims 46-51, wherein said composition is suitable for parenteral injection or infusion, subcutaneous injection, inhalation, or dermal application to a human.

53. The pharmaceutical composition of any of Claims 46-51, wherein said composition is suitable for oral administration to a human.

54. The pharmaceutical composition of Claim 53, wherein said composition comprises an enteric coating.

55. A method for treating and/or preventing the symptoms of pancreatic insufficiency in a subject, comprising providing a subject having pancreatic insufficiency, and providing the pharmaceutical composition of any of Claims 46-54, to said subject.

56. The method of Claim 55, wherein said symptoms of pancreatic insufficiency are ameliorated.

57. The method of Claim 55 and/or 56, wherein said subject is able to consume a diet that is less restricted in its carbohydrate content than diets required by subjects exhibiting the symptoms of pancreatic insufficiency.

58. The method of any of Claims 55-57, wherein said subject is a human patient.

59. The method of Claim 58, wherein said human patient is an infant or child.

60. The method of Claim 58, wherein said human patient is an adult or young adult.

61. The method of any of Claims 55-57, wherein the subject is a non-human mammal.

62. Use of the compositions provided in any of Claims 34, and 46-54.

63. A recombinant amylase according to any of Claims 1-33, or a composition according to any of Claims 34 and 46-54, for use as a medicament.

64. A recombinant amylase according to any of Claims 1-33, or a composition according to any of Claims 34 and 46-54, for use as a nutritional supplement.

65. A recombinant amylase according to any of Claim 1-33, or a composition according to any of Claims 34 and 46-54, for use in the treatment, or prevention of symptoms, of pancreatic insufficiency.

SEQUENCE LISTING

<110> CODEXIS, INC.
SOCIETE DES PRODUITS NESTLE S.A.

<120> ENGINEERED AMYLASE VARIANTS

<130> CX7-211WO2

<150> US 63/071,641
<151> 2020-08-28

<160> 1914

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<211> 1485
<212> DNA
<213> Artificial Sequence

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<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Wild type alpha-amylase from Escherichia coli

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Asp Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100   105   110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
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Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130   135   140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Phe Lys Cys Phe
145   150   155   160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165   170   175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180   185   190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195   200   205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210   215   220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225   230   235   240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ala
                245   250   255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Asp
            260   265   270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
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Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Met Gly Arg
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Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305   310   315   320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
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Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
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Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355   360   365
Asp Leu Tyr Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Gln Thr
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385 390 395 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Leu Phe Phe Asp His
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435 440 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
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<211> 3831
<212> DNA
<213> Artificial Sequence

<220>
<223> wild type alpha-amylase from Alicyclobacillus acidocaldarius

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aacagcctga acggtgtgat cgacgttacc agcgatagcg ttctgaccgg cccgaacagc 300
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<211> 1277
<212> PRT
<213> Artificial Sequence

<220>
<223> wild type alpha-amylase from Alicyclobacillus acidocaldarius

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35 40 45
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50 55 60
Val Asn Gly Leu Asn Leu Asn Pro Ser Ser Phe Lys Val Val Val Ser

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Gly Ala Gly Thr Tyr Thr Val Thr Val Glu Ser Gly Gly Asp Ser Val
        115                 120                 125
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Asp Thr Ile Gln Trp Asp Gly Ile Tyr Thr Ser Asp Gly Ala Met Tyr
145                 150                 155                 160
Val Ser Asp Pro Asn Pro Ser Pro Gly Gln Glu Val Thr Ile Ser Leu
                165                 170                 175
Arg Ala Tyr Ser Gly Asn Leu Thr Lys Val Ile Leu Asn Cys Trp Asp
            180                 185                 190
Thr Ala Gln Asn Lys Gly Phe Gln Val Glu Met Ser Pro Gly Arg Thr
        195                 200                 205
Phe Gly Pro Tyr Gln Leu Trp Ser Ala Thr Ile Pro Ala Ser Asn Gly
    210                 215                 220
Gly Thr Ile Tyr Tyr Arg Phe Asp Ile Tyr Asp Gly Thr Ser Phe Ala
225                 230                 235                 240
Cys Leu Ser Gly Asp Gly Leu His Thr Ser Asp Asp Ile Asn Asn Asn
                245                 250                 255
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            260                 265                 270
Pro Gly Asp Thr Val Thr Val Ser Asp Pro Val Gly Asp Phe Ala Gly
        275                 280                 285
Ser Gln Asp Gln Pro Asn His Thr Val Ile Arg Phe Val Asn Ser Ser
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Gly Glu Thr Ala Ala Thr Val Asn Gly Thr Asn Ala Ser Trp Asn Ser
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Val Gln Phe Thr Val Pro Gln Ser Leu Pro Asn Gly Leu Tyr Arg Val
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Glu Ile Asp Thr Val Ala Lys Asp Ala Asp Gly Val Val Asn Val Glu
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Gln Ala Tyr Ala His Asp Ser Phe Gln Ala Phe Tyr Arg Ser Pro Phe
    370                 375                 380
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385                 390                 395                 400
Leu Ser Val Lys Ser Ala Thr Leu Arg Leu Trp Gly Ala Ala Asp Gln
                405                 410                 415
Ser Gly Glu Ile Asp Leu Pro Met Gln Lys Leu Gln Met Ser Gly Asp
            420                 425                 430
Glu Leu Ala Gln Gln Thr Gly Val Gln Asp Ile Asn Asp Tyr Thr Trp
        435                 440                 445
Trp Thr Val Thr Ile Pro Ala Ala Asp Val Thr Thr Pro Gly Thr Met
    450                 455                 460
Trp Tyr Gln Phe Val Thr Glu Thr Asp Thr Gly Gln Val Val Tyr Tyr
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Ser Asp Gly Pro Ser Tyr Gln Ile Ser Val Tyr Glu Arg Gly Phe Gln
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Lys Gly Ile Tyr Val Gly Ala Asp Gly Thr Glu Ser Leu Gly Pro Ile
545                 550                 555                 560
Gln Phe His Glu Asn Trp Asp Ser Pro Pro Tyr Asp Pro Asn Ile Pro
                565                 570                 575
Pro Leu Ser Asp Pro Lys Ile Ala Ser Leu Arg Gly Asn Gly Gln Trp
            580                 585                 590
Asn Ile Asp Phe Phe Gly Gly Asp Leu Gln Gly Ile Glu Asp Lys Leu
        595                 600                 605
Asp Tyr Leu Lys Ser Leu Gly Val Asn Thr Leu Tyr Leu Met Pro Val
    610                 615                 620
Phe Glu Ala Glu Ser Asn His Lys Tyr Asp Thr Ala Asp Tyr Phe Lys
625                 630                 635                 640
Ile Asp Pro Gly Phe Gly Thr Gln Gln Asp Trp Leu Asn Leu Val Gln
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Ala Ala His Ala Lys Gly Phe His Ile Ile Leu Asp Gly Val Phe Glu
            660                 665                 670
Asp Thr Gly Ser Asp Ser Val Tyr Phe Asn Lys Phe Gly Asn Phe His
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Ser Asn Gly Ala Trp Gln Ala Tyr Leu Lys Asn Gln Pro Ser Leu Ser
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705                 710                 715                 720
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Pro Ala Tyr Gln Arg Phe Val Tyr Gly Ser Asp Asn Ser Val Ala Arg
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Val Trp Ile Arg Glu Gly Ala Asp Gly Trp Arg Leu Asp Ser Ala Asp
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Asn Gly Asn Phe Asn Thr Ala Trp Trp Gly Gly Phe Arg Gln Ala Val
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Lys Ser Ile Asp Pro Asn Ala Ala Ile Ile Gly Glu Ile Trp Asp Asn
785                 790                 795                 800
Ala Thr Asn Asp Asn Gly Thr Asp Trp Leu Thr Gly Ser Thr Phe Asp
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Ser Val Met Asn Tyr Gln Phe Arg Asn Ala Val Ile Asp Phe Phe Arg
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Gly Thr Tyr Asn Asp Gly Asn Val Gln His His Ala Val Asp Ala Ala
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    850                 855                 860
Ser Phe Tyr Ser Met Met Asn Leu Val Asp Ser Gln Asp Thr Met Arg
865                 870                 875                 880
Ile Leu Thr Ile Leu Glu Asn Ala Pro Gln Pro Gly Asp Leu Ser Ala
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Leu Gln Gln Asp Glu Tyr Arg Pro Ser Pro Ala Ala Glu Gln Leu Gly
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Ile Glu Arg Leu Lys Leu Val Ser Asp Phe Gln Phe Ser Phe Pro Gly
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Val Leu Gln Thr Gly Asp Phe Thr Pro Leu Tyr Ala Gln Gly Met Val
            980                 985                 990
Tyr Ala Phe Ala Arg Thr Ile Arg Asn Gly Arg Asp Val Phe Gly Val
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Pro Ala Glu Asp Ala Thr Ala Ile Val Ala Ile Asn Asn Gln Asn Gln
    1010                1015                1020
Ala Ile Thr Val Thr Ile Pro Thr Asp Gly Thr Val Ala Asp Gly Ser
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Arg Gln Asn Pro Asn Gly Gln Trp Val Pro Phe Gly Pro Val Leu Pro
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Val Ser Ala Pro Lys Thr Val Ser Leu Ala Val Asp Val Pro Ala Val
        1155                1160                1165
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Ser Gly Asp Ser Ala Ala Ile Gly Glu Val Pro Ala Gln Gly Pro Ala
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Asn Ser Pro His Ala Thr Ile Arg Val Thr Val Pro Val Pro Ala Gly
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Phe Ser Ser Val Thr Tyr Arg Val Ala Ala Gln Asn Glu Asp Gly Gln
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<210> 5
<211> 1458
<212> DNA
<213> Artificial Sequence

<220>
<223> wild type alpha-amylase from Cytophaga sp.

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ccggcgctga agagcaaaat tgaaccgctg ctgaaggcgc gtaaagatta cgcgtatggt 1200
acccaacgtg attacatcga caacccggat gttattggct ggacccgtga gggtgacagc 1260
accaaggcga aaagcggcct ggcgaccgtg atcaccgatg gtccgggcgg tagcaaacgt 1320
atgtatgttg gcaccagcaa cgcgggtgaa atttggtacg acctgaccgg caaccgtacc 1380
gataagatca ccattggtag cgatggttat gcgaccttcc cggtgaatgg tggtagcgtg 1440
agcgtgtggg tgcaacaa 1458

<210> 6
<211> 486
<212> PRT
<213> Artificial Sequence

<220>
<223> wild type alpha-amylase from Cytophaga sp.

<400> 6
Met Ala Ala Thr Asn Gly Thr Met Met Gln Tyr Phe Glu Trp Tyr Val
1 5 10 15
Pro Asn Asp Gly Gln Gln Trp Asn Arg Leu Arg Thr Asp Ala Pro Tyr
            20 25 30
Leu Ser Ser Val Gly Ile Thr Ala Val Trp Thr Pro Pro Ala Tyr Lys
        35 40 45
Gly Thr Ser Gln Ala Asp Val Gly Tyr Gly Pro Tyr Asp Leu Tyr Asp
    50 55 60
Leu Gly Glu Phe Asn Gln Lys Gly Thr Val Arg Thr Lys Tyr Gly Thr
65 70 75 80
Lys Gly Glu Leu Lys Ser Ala Val Asn Thr Leu His Ser Asn Gly Ile
                85 90 95
Gln Val Tyr Gly Asp Val Val Met Asn His Lys Ala Gly Ala Asp Tyr
            100 105 110
Thr Glu Asn Val Thr Ala Val Glu Val Asn Pro Ser Asn Arg Asn Gln
        115 120 125
Glu Thr Ser Gly Glu Tyr Asn Ile Gln Ala Trp Thr Gly Phe Asn Phe
    130 135 140

```
Pro Gly Arg Gly Thr Thr Tyr Ser Asn Phe Lys Trp Gln Trp Phe His
145                 150                 155                 160
Phe Asp Gly Thr Asp Trp Asp Gln Ser Arg Ser Leu Ser Arg Ile Phe
                165                 170                 175
Lys Phe Arg Gly Thr Gly Lys Ala Trp Asp Trp Glu Val Ser Ser Glu
            180                 185                 190
Asn Gly Asn Tyr Asp Tyr Leu Met Tyr Ala Asp Ile Asp Tyr Asp His
        195                 200                 205
Pro Asp Val Val Asn Glu Met Lys Lys Trp Gly Val Trp Tyr Ala Asn
    210                 215                 220
Glu Val Gly Leu Asp Gly Tyr Arg Leu Asp Ala Val Lys His Ile Lys
225                 230                 235                 240
Phe Ser Phe Leu Lys Asp Trp Val Asp Asn Ala Arg Ala Ala Thr Gly
                245                 250                 255
Lys Glu Met Phe Thr Val Gly Glu Tyr Trp Gln Asn Asp Leu Gly Ala
            260                 265                 270
Leu Asn Asn Tyr Leu Ala Lys Val Asn Tyr Asn Gln Ser Leu Phe Asp
        275                 280                 285
Ala Pro Leu His Tyr Asn Phe Tyr Ala Ala Ser Thr Gly Gly Gly Tyr
    290                 295                 300
Tyr Asp Met Arg Asn Ile Leu Asn Asn Thr Leu Val Ala Ser Asn Pro
305                 310                 315                 320
Thr Lys Ala Val Thr Leu Val Glu Asn His Asp Thr Gln Pro Gly Gln
                325                 330                 335
Ser Leu Glu Ser Thr Val Gln Pro Trp Phe Lys Pro Leu Ala Tyr Ala
            340                 345                 350
Phe Ile Leu Thr Arg Ser Gly Gly Tyr Pro Ser Val Phe Tyr Gly Asp
        355                 360                 365
Met Tyr Gly Thr Lys Gly Thr Thr Thr Arg Glu Ile Pro Ala Leu Lys
    370                 375                 380
Ser Lys Ile Glu Pro Leu Leu Lys Ala Arg Lys Asp Tyr Ala Tyr Gly
385                 390                 395                 400
Thr Gln Arg Asp Tyr Ile Asp Asn Pro Asp Val Ile Gly Trp Thr Arg
                405                 410                 415
Glu Gly Asp Ser Thr Lys Ala Lys Ser Gly Leu Ala Thr Val Ile Thr
            420                 425                 430
Asp Gly Pro Gly Gly Ser Lys Arg Met Tyr Val Gly Thr Ser Asn Ala
        435                 440                 445
Gly Glu Ile Trp Tyr Asp Leu Thr Gly Asn Arg Thr Asp Lys Ile Thr
    450                 455                 460
Ile Gly Ser Asp Gly Tyr Ala Thr Phe Pro Val Asn Gly Gly Ser Val
465                 470                 475                 480
Ser Val Trp Val Gln Gln
                485
```

<210> 7
<211> 1482
<212> DNA
<213> Artificial Sequence

<220>
<223> wild type alpha-amylase from Salmonella typhimurium

<400> 7
atgaagaacc cgaccctgct gcaatacttt cactggtact acccggacgg tggcaaactg 60
tggagcgaac tggcggagcg tgcggatggt ctgaacgaca tcggcattaa catggtgtgg 120
ctgccgccgg cgtgcaaagg tgcgagcggt ggctatagcg ttggctacga cacctacgac 180
ctgttcgacc tgggcgagtt tgatcagaag ggcaccatcg cgaccaagta cggtgacaaa 240
cgtcaactgc tgaccgcgat cgatgcgctg aagaaaaaca acatcgcggt tctgctggac 300
gtggttgtga accacaagat gggcgcggat gagaaagaac gtatccgtgt gcagcgtgtt 360
aaccaagacg atcgtaccca gattgacgat aacatcattg agtgcgaagg ttggacccgt 420
tacaccttcc cggcgcgtgc gggtcaatat agcaacttca tctgggacta ccactgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat cgtgaacgat 540
tacaccggtg acggctggaa cgatcaggtt gacgatgaga tgggtaactt cgactacctg 600
atgggcgaaa acatcgattt tcgtaaccac gcggtgaccg aggaaattaa gtattgggcg 660
cgttgggtta tggagcagac ccactgcgac ggtttccgtc tggatgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag cggttgcgcc gaaaccgctg 780
ttcatcgtgg cggagtattg gagccacgaa gttgacaagc tgcagaccta cattgatcaa 840
gttgacggta aaaccatgct gttcgatgcg ccgctgcaga tgaagtttca cgaggcgagc 900
cgtcaaggtg ctgaatatga catgcgtcac atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtacgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg tatggcgcga gctacgaaga tagcggcgag 1140
aacggcgaaa cctgccgtgt ggacatgccg gttatcaacc agctggatcg tctgattctg 1200
gcgcgtcagc gtttcgcgca cggtatccaa accctgttct ttgaccaccc gaactgcatt 1260
gcgtttagcc gtagcggtac cgaggaaaac ccgggctgcg ttgtggttct gagcaacggt 1320
gacgatggcg agaaaaccct gctgctgggt gacaactatg cgaacaagac ctggcgtgac 1380
ttcctgggca accgtgatga atacgtggtt accaacgatc aaggtgaggc gacctttttc 1440
tgcaatgcgg gtagcgttag cgtttgggtt atcgaagatg tt 1482

<210> 8
<211> 494
<212> PRT
<213> Artificial Sequence

<220>
<223> wild type alpha-amylase from Salmonella typhimurium

<400> 8
Met Lys Asn Pro Thr Leu Leu Gln Tyr Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Ser Glu Leu Ala Glu Arg Ala Asp Gly Leu Asn
            20 25 30
Asp Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Cys Lys Gly Ala
        35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
    50 55 60
Gly Glu Phe Asp Gln Lys Gly Thr Ile Ala Thr Lys Tyr Gly Asp Lys
65 70 75 80
Arg Gln Leu Leu Thr Ala Ile Asp Ala Leu Lys Lys Asn Asn Ile Ala
                85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100 105 110
Glu Arg Ile Arg Val Gln Arg Val Asn Gln Asp Asp Arg Thr Gln Ile
        115 120 125
Asp Asp Asn Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro

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    130                 135                 140
Ala Arg Ala Gly Gln Tyr Ser Asn Phe Ile Trp Asp Tyr His Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Gly Asp Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Met Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr His Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Ala Val Ala
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Asp
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Asp Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Ala
    290                 295                 300
Glu Tyr Asp Met Arg His Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Tyr Gly Ala Ser Tyr Glu Asp Ser Gly Glu Asn Gly Glu Thr
    370                 375                 380
Cys Arg Val Asp Met Pro Val Ile Asn Gln Leu Asp Arg Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Ile Gln Thr Leu Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Glu Glu Asn Pro Gly
            420                 425                 430
Cys Val Val Val Leu Ser Asn Gly Asp Asp Gly Glu Lys Thr Leu Leu
        435                 440                 445
Leu Gly Asp Asn Tyr Ala Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Asp Glu Tyr Val Val Thr Asn Asp Gln Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Ala Gly Ser Val Ser Val Trp Val Ile Glu Asp Val
                485                 490
```

<210> 9
<211> 1362
<212> DNA
<213> Artificial Sequence

<220>
<223> wild type alpha-amylase from Pantoea ananatis

<400> 9
atggcgccgc cgtgctacaa gggtgaaagc ggtggttaca gcgtgggtta cgacagctat 60
gacctgtttg acctgggtga atttgaacag aagggtagca aagcgaccaa gtacggcgac 120
aaacagcaac tgctggatgc ggttaacgcg ctgcgtagcc acgacatcgg tgtgctgctg 180
gatgtggttg tgaaccacaa aatgggcgcg gacgagaagg aacagattcg tgttaaccgt 240
gtgaacccgg acaaccgtga tgagatctat ccggatgtta ttgagtgcga agcgtggacc 300
cgtttcaact ttccggcgcg tgcgggtcaa tacagcaaat tcatctggga ctataagtgc 360
tttagcggtg ttgaccacat tgagaacccg gatgaaaacg gcgtgttcaa aatcattaac 420
gattacaccg cggagggctg gaacgaccag gttgatagcg aactgggtaa cttcgactat 480
ctgatgggcg cgaacatcga ttttcgtaac aacgcggtga gcgaggaact gaagtactgg 540
gcgcgttggg ttatggagca ggtgccgtgc accggtttcc gtctggacgc ggtgaaacac 600
atcccggcgt ggttttataa ggcgtggatt gatcacgttc aagaggtggc gaacgaaccg 660
ctgttcatcg ttgcggagta ctggagcttt gaaaccgaca aactgcagga atatattcac 720
caagtggacg gcaagaccat gctgttcgat gcgccgctgc acatgaactt tcaccaggcg 780
agcaaagcgg gcagcgcgta cgacctgagc aagatcttcg ataacagcct ggttctggcg 840
gacccgtggc atgcggttac cattgtggcg aaccacgata cccaaccgct gcaaagcctg 900
gaggcgccgg tggaagcgtg gtttaagccg ctggcgtatg cgctgatcct gctgcgtgag 960
caaggtgttc cgaccgtgtt ctacccggac ctgtttggtg cgagctatca ggatgaaggt 1020
ggcgacggcg atgttcacca agtggacatg ccggttatcc cggagctgga aggcctgatt 1080
cgtgcgcgtc agctgtttgg ttggggcgcg caaaccgact acttcgatca cccgaactgc 1140
gtggcgttta gccgtagcgg taccgcggaa aaaccgggct gcgttgtgat catgagcaac 1200
ggcgaggcgg gcgaaaagca cattgcgatg ggcgagggct acgcgggtaa agtttggcgt 1260
gattatctgg gccacaagag cgaaaccatt accaccgacg ataatggtag cgcgctgttt 1320
agctgcaatg gtggtagcgt tagcgtttgg gttgtggagg cg 1362

<210> 10
<211> 454
<212> PRT
<213> Artificial Sequence

<220>
<223> wild type alpha-amylase from Pantoea ananatis

<400> 10
Met Ala Pro Pro Cys Tyr Lys Gly Glu Ser Gly Gly Tyr Ser Val Gly
1   5   10   15
Tyr Asp Ser Tyr Asp Leu Phe Asp Leu Gly Glu Phe Glu Gln Lys Gly
            20   25   30
Ser Lys Ala Thr Lys Tyr Gly Asp Lys Gln Gln Leu Leu Asp Ala Val
        35   40   45
Asn Ala Leu Arg Ser His Asp Ile Gly Val Leu Leu Asp Val Val Val
    50   55   60
Asn His Lys Met Gly Ala Asp Glu Lys Glu Gln Ile Arg Val Asn Arg
65   70   75   80
Val Asn Pro Asp Asn Arg Asp Glu Ile Tyr Pro Asp Val Ile Glu Cys
                85   90   95
Glu Ala Trp Thr Arg Phe Asn Phe Pro Ala Arg Ala Gly Gln Tyr Ser
            100   105   110
Lys Phe Ile Trp Asp Tyr Lys Cys Phe Ser Gly Val Asp His Ile Glu
        115   120   125
Asn Pro Asp Glu Asn Gly Val Phe Lys Ile Ile Asn Asp Tyr Thr Ala
    130   135   140

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Glu Gly Trp Asn Asp Gln Val Asp Ser Glu Leu Gly Asn Phe Asp Tyr
145                 150                 155                 160
Leu Met Gly Ala Asn Ile Asp Phe Arg Asn Asn Ala Val Ser Glu Glu
                165                 170                 175
Leu Lys Tyr Trp Ala Arg Trp Val Met Glu Gln Val Pro Cys Thr Gly
            180                 185                 190
Phe Arg Leu Asp Ala Val Lys His Ile Pro Ala Trp Phe Tyr Lys Ala
        195                 200                 205
Trp Ile Asp His Val Gln Glu Val Ala Asn Glu Pro Leu Phe Ile Val
    210                 215                 220
Ala Glu Tyr Trp Ser Phe Glu Thr Asp Lys Leu Gln Glu Tyr Ile His
225                 230                 235                 240
Gln Val Asp Gly Lys Thr Met Leu Phe Asp Ala Pro Leu His Met Asn
                245                 250                 255
Phe His Gln Ala Ser Lys Ala Gly Ser Ala Tyr Asp Leu Ser Lys Ile
            260                 265                 270
Phe Asp Asn Ser Leu Val Leu Ala Asp Pro Trp His Ala Val Thr Ile
        275                 280                 285
Val Ala Asn His Asp Thr Gln Pro Leu Gln Ser Leu Glu Ala Pro Val
    290                 295                 300
Glu Ala Trp Phe Lys Pro Leu Ala Tyr Ala Leu Ile Leu Leu Arg Glu
305                 310                 315                 320
Gln Gly Val Pro Thr Val Phe Tyr Pro Asp Leu Phe Gly Ala Ser Tyr
                325                 330                 335
Gln Asp Glu Gly Gly Asp Gly Asp Val His Gln Val Asp Met Pro Val
            340                 345                 350
Ile Pro Glu Leu Glu Gly Leu Ile Arg Ala Arg Gln Leu Phe Gly Trp
        355                 360                 365
Gly Ala Gln Thr Asp Tyr Phe Asp His Pro Asn Cys Val Ala Phe Ser
    370                 375                 380
Arg Ser Gly Thr Ala Glu Lys Pro Gly Cys Val Val Ile Met Ser Asn
385                 390                 395                 400
Gly Glu Ala Gly Glu Lys His Ile Ala Met Gly Glu Gly Tyr Ala Gly
                405                 410                 415
Lys Val Trp Arg Asp Tyr Leu Gly His Lys Ser Glu Thr Ile Thr Thr
            420                 425                 430
Asp Asp Asn Gly Ser Ala Leu Phe Ser Cys Asn Gly Gly Ser Val Ser
        435                 440                 445
Val Trp Val Val Glu Ala
    450
```

<210> 11
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> wild type alpha-amylase from Yersinia kristensenii

<400> 11
atgaagaacc cgaccatttt ccagtttttc cattggtatt acccggacgg cggcaagctg 60
tggcaagaag tggcggagcg tgcggagcac atcagccagc tgggtattaa ctacgtgtgg 120
ctgccgccgg cgtataaggg tgcgagcggt ggctacagcg ttggctacga cacctacgac 180

ctgttcgacc tgggcgagtt tgatcaaaaa ggcacccagg cgaccaagta cggtaacaaa 240
gagggcctgg tgaacgcgat caaccgtctg aaggaaatgg atatcaaaat tctgttcgac 300
gtggttttta accacaagat gggtgcggac gagaaagaac cggtgagcgt tcacaacgtg 360
aacctggaga accgtaccga tatcgacgat gaagttattg acgcgcaagc gtatacccgt 420
ttcacctttc cgggtcgtaa caagaaatac agcagcttca tctgggataa gcagtgcatg 480
aacggcgttg atcacatcga ggacccgacc ggtgaaggca tcttcaagat catcaacgat 540
tacagcaacg agggttgggg caccgaggtg gacgatgaac tgggtaactt cgactacctg 600
atgggcgcgg acatcgattt tcgtaacccg gcggttattg gtgaactgaa ctattggggc 660
gagtggctgc tggaaatgct gccgatcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tctttcgtca gtggattcaa cacgttcaga acaaagcgga ccacgatctg 780
ctgatcattg cggagtattg gagcccggac attgcgaagc tgcagcaata cctggaacgt 840
gtggatggcc tggcgatgct gttcgacgtt gcgctgcacc acaaatttca cgaggcgagc 900
aaccaaggtg aagacttcga tctgacccag gtgtttagcg gcaccctgat cgaggcggat 960
ccgatgcaca ccattaccat ggtggcgaac cacgacaccc agccgctgca gagcctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtacgcgc tgatcctgat tcgtgaacaa 1080
ggtatcccgt gcgttttcta tccggacctg ttcggtgcga actacgagga caccggcgac 1140
gatggtggca cctatcagat cgaaatgccg atcattaccg agctggaaaa gctgattcaa 1200
gcgcgtaaac gttttgcgca cggcgcgcag agcgattact tcgacgataa aaactgcatc 1260
gcgtttgtgc gtgcgggtac cgaggaaaac ccgggctgca tcgtgattct gagcaacggt 1320
gcggagaacg aaaaggttat tatgctgggc gagaacctgg cgaacaaaga gttcggtgat 1380
tttctgggca accacccggc gatcattacc accgacaaca gcggtgaagc ggtgttcccg 1440
gttagccgtg gtagcgtgag cctgtgggtt cagaaagagt tcctgcaa 1488

<210> 12
<211> 496
<212> PRT
<213> Artificial Sequence

<220>
<223> wild type alpha-amylase from Yersinia kristensenii

<400> 12
Met Lys Asn Pro Thr Ile Phe Gln Phe Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Gln Glu Val Ala Glu Arg Ala Glu His Ile Ser
20 25 30
Gln Leu Gly Ile Asn Tyr Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Thr Gln Ala Thr Lys Tyr Gly Asn Lys
65 70 75 80
Glu Gly Leu Val Asn Ala Ile Asn Arg Leu Lys Glu Met Asp Ile Lys
85 90 95
Ile Leu Phe Asp Val Val Phe Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu Pro Val Ser Val His Asn Val Asn Leu Glu Asn Arg Thr Asp Ile
115 120 125
Asp Asp Glu Val Ile Asp Ala Gln Ala Tyr Thr Arg Phe Thr Phe Pro
130 135 140
Gly Arg Asn Lys Lys Tyr Ser Ser Phe Ile Trp Asp Lys Gln Cys Met
145 150 155 160
Asn Gly Val Asp His Ile Glu Asp Pro Thr Gly Glu Gly Ile Phe Lys

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                165                 170                 175
Ile Ile Asn Asp Tyr Ser Asn Glu Gly Trp Gly Thr Glu Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Ala Asp Ile Asp Phe Arg
        195                 200                 205
Asn Pro Ala Val Ile Gly Glu Leu Asn Tyr Trp Gly Glu Trp Leu Leu
    210                 215                 220
Glu Met Leu Pro Ile Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Phe Arg Gln Trp Ile Gln His Val Gln Asn Lys Ala
                245                 250                 255
Asp His Asp Leu Leu Ile Ile Ala Glu Tyr Trp Ser Pro Asp Ile Ala
            260                 265                 270
Lys Leu Gln Gln Tyr Leu Glu Arg Val Asp Gly Leu Ala Met Leu Phe
        275                 280                 285
Asp Val Ala Leu His His Lys Phe His Glu Ala Ser Asn Gln Gly Glu
    290                 295                 300
Asp Phe Asp Leu Thr Gln Val Phe Ser Gly Thr Leu Ile Glu Ala Asp
305                 310                 315                 320
Pro Met His Thr Ile Thr Met Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ser Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Ile Arg Glu Gln Gly Ile Pro Cys Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala Asn Tyr Glu Asp Thr Gly Asp Asp Gly Gly Thr
    370                 375                 380
Tyr Gln Ile Glu Met Pro Ile Ile Thr Glu Leu Glu Lys Leu Ile Gln
385                 390                 395                 400
Ala Arg Lys Arg Phe Ala His Gly Ala Gln Ser Asp Tyr Phe Asp Asp
                405                 410                 415
Lys Asn Cys Ile Ala Phe Val Arg Ala Gly Thr Glu Glu Asn Pro Gly
            420                 425                 430
Cys Ile Val Ile Leu Ser Asn Gly Ala Glu Asn Glu Lys Val Ile Met
        435                 440                 445
Leu Gly Glu Asn Leu Ala Asn Lys Glu Phe Gly Asp Phe Leu Gly Asn
    450                 455                 460
His Pro Ala Ile Ile Thr Thr Asp Asn Ser Gly Glu Ala Val Phe Pro
465                 470                 475                 480
Val Ser Arg Gly Ser Val Ser Leu Trp Val Gln Lys Glu Phe Leu Gln
                485                 490                 495
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<210> 13
<211> 1485
<212> DNA
<213> Artificial Sequence

<220>
<223> wild type alpha-amylase from Enterobacteriaceae bacterium LSJC7

<400> 13
atgaagaacc cgaccattgt gcagtatttc cattggtatt atccgggcga tagcaagctg 60
tggccggaag tgaccgagcg tgcggcgagc ctgcgtgaga tgggtatcag catggtttgg 120

ctgccgccgg cgtataaggg tagcgcgggt ggctttagcg tgggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgatcagaaa ggcagcgttg cgaccaagta cggtgacaaa 240
ggccaactgc tggcggcgat cgaagcgctg caccagcaag atattgcggt gctgctggac 300
gtggttatga accacaagat gggtgcggat gagaaagaac gtatccaggt tatgcgtgtg 360
aacccggaca accgtaacga cattgatgaa accgcgttcg aatgcgatgc gtggacccgt 420
tatacctttc cggcgcgtca gggcaagtac agcgagttca tctgggattt ccgttgcttt 480
agcggtgttg accacattga gaacccggac gaagatggca tcttcaagat cgttaacgat 540
tacagcggcg agggctggaa cgaccaggtg gacgatgaaa agggtaactt tgattacctg 600
atgggcagca acatcgactt ccgtaaccaa gcggttaccg aggaactgaa gtattgggcg 660
cgttgggtga tgaacgaaac ccgttgcgat ggttttcgtc tggacgcggt taaacacatc 720
ccggcgtggt tctaccgtct gtggattgac cacgttcagg aagtggcgcc gaacccgctg 780
ttcatcgttg cggaatactg gagctatgag gtggaagcgc tgcagcaata tattgatcag 840
gtggagggca agaccatgct gttcgacgcg ccgctgcaaa acaactttca caacgcgagc 900
aaagcgggtc gtgactacga tatgcgtcaa atctttgatg gcaccctggt tgaagcggac 960
ccgttccacg cggttaccct ggtggcgaac catgacaccc aaccgctgca agcgctggag 1020
gcgccggtgg aaccgtggtt taaaccgctg gcgtacgcgc tgattctgct gcgtgagaac 1080
ggtgttccga gcgtgttcta cccggatctg tatggcgcgc actacgaaga caccggtgac 1140
gatggcaacg tttggccggt ggacattccg gcgattgcgc agctgccgga gctgctgcgt 1200
gttcgtcagc gttatgcgca cggtgtgcaa cgtctgttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgacgatgaa ccgggctgcg tggttgtgat gagcaacggt 1320
gatgagggcg aaaaggcgat tgcgctgggc gagaactacg gcgataaacg ttggcgtgac 1380
gttctgggtc accgtgatga aaccgtgacc accgacgcgc agggcaatgg tgtgtttacc 1440
tgcaacggtg gcagcgtgag cgtgtgggtg attgaggaga ccctg 1485

<210> 14
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> wild type alpha-amylase from Enterobacteriaceae bacterium LSJC7

<400> 14
Met Lys Asn Pro Thr Ile Val Gln Tyr Phe His Trp Tyr Tyr Pro Gly
1 5 10 15
Asp Ser Lys Leu Trp Pro Glu Val Thr Glu Arg Ala Ala Ser Leu Arg
20 25 30
Glu Met Gly Ile Ser Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ser
35 40 45
Ala Gly Gly Phe Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Val Ala Thr Lys Tyr Gly Asp Lys
65 70 75 80
Gly Gln Leu Leu Ala Ala Ile Glu Ala Leu His Gln Gln Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Met Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu Arg Ile Gln Val Met Arg Val Asn Pro Asp Asn Arg Asn Asp Ile
115 120 125
Asp Glu Thr Ala Phe Glu Cys Asp Ala Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Gln Gly Lys Tyr Ser Glu Phe Ile Trp Asp Phe Arg Cys Phe
145 150 155 160

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Ser Gly Val Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Ser Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Lys Gly Asn Phe Asp Tyr Leu Met Gly Ser Asn Ile Asp Phe Arg
        195                 200                 205
Asn Gln Ala Val Thr Glu Glu Leu Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Asn Glu Thr Arg Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Leu Trp Ile Asp His Val Gln Glu Val Ala
                245                 250                 255
Pro Asn Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser Tyr Glu Val Glu
            260                 265                 270
Ala Leu Gln Gln Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Asn Asn Phe His Asn Ala Ser Lys Ala Gly Arg
    290                 295                 300
Asp Tyr Asp Met Arg Gln Ile Phe Asp Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Tyr Gly Ala His Tyr Glu Asp Thr Gly Asp Asp Gly Asn Val
    370                 375                 380
Trp Pro Val Asp Ile Pro Ala Ile Ala Gln Leu Pro Glu Leu Leu Arg
385                 390                 395                 400
Val Arg Gln Arg Tyr Ala His Gly Val Gln Arg Leu Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Asp Glu Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Glu Gly Glu Lys Ala Ile Ala
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asp Lys Arg Trp Arg Asp Val Leu Gly His
    450                 455                 460
Arg Asp Glu Thr Val Thr Thr Asp Ala Gln Gly Asn Gly Val Phe Thr
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Thr Leu
                485                 490                 495
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<210> 15
<211> 1461
<212> DNA
<213> Artificial Sequence

<220>
<223> wild type alpha-amylase from Bacillus coahuilensis

<400> 15
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ggccaacact ggaaccgcct gaataatgat gcggcgcacc tgcaggacct gggtgtgacc 120
gcggtttgga tcccgccggc gtacaaaggc accagccaaa acgatgtggg ttacggcgcg 180
tatgatctgt acgacctggg cgagttcaac cagaagggca ccacccgtac caagtatggt 240
accaaagcgc agctgaagca agcgatcagc agcctgcaca accgtggtat tcaggtttat 300
ggcgatgtgg ttatgaacca caaaggtggc gcggactaca cccagatggt gagcgcggtg 360
gaagttgatc gttataaccg taaccaagag gttaccggtg aataccagat ccaagcgtgg 420
accggtttca actttccggg ccgtaacaac acctatagcc cgttcaagtg gcagtggtac 480
cactttgacg gcaccgactg ggatcaaagc cgtagcctga accgtattta caaattccgt 540
ggtaccggca aggcgtggga ttgggaagtg gcgagcgaat atggtaacta cgactatctg 600
atgtacgcgg acgtggattt cgaccacccg gacgttcagc aagagatgaa aaactggggc 660
acctggtatg cgaacgaact gggtctggat ggctttcgtc tggacgcggt gaagcacatc 720
aaacacagct acctgcagga ttgggtgacc gcggttcgtc aaaacaccgg taaagagatg 780
tttaccgttg cggaatactg gcagaacgac ctgggtgcga ttcaaaacta tctgaccaag 840
accggctaca cccacagcgc gttcgatgtg ccgctgcact ataactttca gcaagcgagc 900
aacagcagcg gtagctacga catgcgtaac ctgctgaacg gcaccctgat ggcggcgaac 960
ccgaccaaag cggtgaccat tgttgagaac cacgatagcc agccgggtca agcgctggaa 1020
agcaccgttc agagctggtt caagccgctg gcgtatgcgt ttatcctgac ccgtcaagag 1080
ggttatccgg cgctgtttta cggcgattac tatggtacca agggcaccac cagctacgaa 1140
attccggcgc tgggtagcaa actggacccg ctgctgcagg cgcgtaagag ctacgcgtat 1200
ggcagccaac acgattatct gaaccactgg gacatcattg gttggacccg tgagggcgtg 1260
agcagccgtc agaaaagcgg tctggcgacc ctgatcaccg atggtccggg tggtaacaaa 1320
tggatgtacg ttggcaagca gaacgcgggc gaaacctgga aggatatgac cggtaaccgt 1380
agcgaccaag tggttattaa ccaggacggc tggggcaact tttatgtgaa tggcggtagc 1440
gtgagcgtgt atgtgcaaca a 1461

<210> 16
<211> 487
<212> PRT
<213> Artificial Sequence

<220>
<223> wild type alpha-amylase from Bacillus coahuilensis

<400> 16
Met Ser Ala Asn Thr Asn Gly Thr Met Met Gln Tyr Phe Glu Trp Tyr
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Leu Pro Asn Asp Gly Gln His Trp Asn Arg Leu Asn Asn Asp Ala Ala
20 25 30
His Leu Gln Asp Leu Gly Val Thr Ala Val Trp Ile Pro Pro Ala Tyr
35 40 45
Lys Gly Thr Ser Gln Asn Asp Val Gly Tyr Gly Ala Tyr Asp Leu Tyr
50 55 60
Asp Leu Gly Glu Phe Asn Gln Lys Gly Thr Thr Arg Thr Lys Tyr Gly
65 70 75 80
Thr Lys Ala Gln Leu Lys Gln Ala Ile Ser Ser Leu His Asn Arg Gly
85 90 95
Ile Gln Val Tyr Gly Asp Val Val Met Asn His Lys Gly Gly Ala Asp
100 105 110
Tyr Thr Gln Met Val Ser Ala Val Glu Val Asp Arg Tyr Asn Arg Asn
115 120 125
Gln Glu Val Thr Gly Glu Tyr Gln Ile Gln Ala Trp Thr Gly Phe Asn
130 135 140
Phe Pro Gly Arg Asn Asn Thr Tyr Ser Pro Phe Lys Trp Gln Trp Tyr

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145                 150                 155                 160
His Phe Asp Gly Thr Asp Trp Asp Gln Ser Arg Ser Leu Asn Arg Ile
                165                 170                 175
Tyr Lys Phe Arg Gly Thr Gly Lys Ala Trp Asp Trp Glu Val Ala Ser
            180                 185                 190
Glu Tyr Gly Asn Tyr Asp Tyr Leu Met Tyr Ala Asp Val Asp Phe Asp
        195                 200                 205
His Pro Asp Val Gln Gln Glu Met Lys Asn Trp Gly Thr Trp Tyr Ala
    210                 215                 220
Asn Glu Leu Gly Leu Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Lys His Ser Tyr Leu Gln Asp Trp Val Thr Ala Val Arg Gln Asn Thr
                245                 250                 255
Gly Lys Glu Met Phe Thr Val Ala Glu Tyr Trp Gln Asn Asp Leu Gly
            260                 265                 270
Ala Ile Gln Asn Tyr Leu Thr Lys Thr Gly Tyr Thr His Ser Ala Phe
        275                 280                 285
Asp Val Pro Leu His Tyr Asn Phe Gln Gln Ala Ser Asn Ser Ser Gly
    290                 295                 300
Ser Tyr Asp Met Arg Asn Leu Leu Asn Gly Thr Leu Met Ala Ala Asn
305                 310                 315                 320
Pro Thr Lys Ala Val Thr Ile Val Glu Asn His Asp Ser Gln Pro Gly
                325                 330                 335
Gln Ala Leu Glu Ser Thr Val Gln Ser Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Phe Ile Leu Thr Arg Gln Glu Gly Tyr Pro Ala Leu Phe Tyr Gly
        355                 360                 365
Asp Tyr Tyr Gly Thr Lys Gly Thr Thr Ser Tyr Glu Ile Pro Ala Leu
    370                 375                 380
Gly Ser Lys Leu Asp Pro Leu Leu Gln Ala Arg Lys Ser Tyr Ala Tyr
385                 390                 395                 400
Gly Ser Gln His Asp Tyr Leu Asn His Trp Asp Ile Ile Gly Trp Thr
                405                 410                 415
Arg Glu Gly Val Ser Ser Arg Gln Lys Ser Gly Leu Ala Thr Leu Ile
            420                 425                 430
Thr Asp Gly Pro Gly Gly Asn Lys Trp Met Tyr Val Gly Lys Gln Asn
        435                 440                 445
Ala Gly Glu Thr Trp Lys Asp Met Thr Gly Asn Arg Ser Asp Gln Val
    450                 455                 460
Val Ile Asn Gln Asp Gly Trp Gly Asn Phe Tyr Val Asn Gly Gly Ser
465                 470                 475                 480
Val Ser Val Tyr Val Gln Gln
                485
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<210> 17
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 17

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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggactt caaatgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggttgcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttgacaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtatgggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg tatggtgcgc actacgaaga tgtgggtggc 1140
gacggccaga cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accctgttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggtt accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 18
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 18
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Glu
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Asp Gly Phe Asn
20 25 30
Asp Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
115 120 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro

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    130                 135                 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Phe Lys Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ala
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Asp
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Met Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Tyr Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Gln Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Leu Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 19
<211> 2031
<212> DNA
<213> Artificial Sequence

<220>
<223> Wild type serine endopeptidase from Microcoleus sp. PCC 7113

<400> 19
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gagcatattg ttgtgcgtac cgagaaccgt agcatcctga ccgaaacccg tccgtacgag 120
gtgaccagcg ttagcccgga ggcgcgtaac atcctggacc agttcgagct ggaaacccgt 180
tttcgtgcgg cgggtgtgga gattctgcgt gcgaaggacc cgcgtgaaaa cagcgcgctg 240
cgtgataccg cgcgtgttat cctgaaccag gaaccggcga ttcaattcgc gggccgtgtg 300
ctggttgatc cgcagagcat gcaaccggtg gtttacaccg agaacatctt cgtgaagttt 360
gacgatgaaa cccagagcgg tgcgtgccaa gagatcctgg aacgttatgg cctgaccatt 420
aaacgtgagc tgggttacgc gcgtaacgcg tatttcgtta gcgcgccgga aaacaccggc 480
ctgaccatct ttgacattgc gagccgtctg ctgaacgagg aaagcgtgga gctgtgccac 540
ccggagctgg ttcgtgaaat caacaagcgt caggcgttcc cgcagcaatg gcacctgaaa 600
ccgaccacca tccgcggtca agcgattaac gcggatgcga acgtggaagc ggcgtggagc 660
ctgagcaacg gtaccggtac caccatcgcg atcattgacg atggcgtgga cctggaccac 720
gaggaatttc gtaccgcggg taaaattgtg gcgccgcgtg acgttacccg taagaccaac 780
gacccgcgtc cgggtaaccg tgataaccat ggtaccgcgt gcgcgggtgt ggcgtgcgcg 840
aacggtaacg ttggtgcgag cggtgttgcg ccgggtgcgc gtctgatgcc gatccgtttc 900
gtcagcggtc tgggcagcca ggaggaagcg gatgcgtttg tttgggcggc gcaaaacggt 960
gcggatgtta ttagctgcag ctggggtccg ccggacggtg tttggtacaa cccgtgggat 1020
ccgcgccaca accagaagtt tccgctgccg gacagcaccc gtctggcgat ggatttcgcg 1080
atcaaccaag gccgtaacgg taaaggctgc gtgattctgt ttgcggcggg taacggcaac 1140
gagagcgttg acaacgatgg ttacgcgagc tatgaaaagg tgatcgcggt tgcggcgtgc 1200
aacgacagca gcgtcaaaag cgtctatagc gatttcggca acgcggtttg gtgcgcgttt 1260
ccgagcaacg acggccgtcc tagcaaaacc ccgggtattt ggaccaccga tcgtatgggc 1320
cgtctgggtt acaaccgggg taacctgcgc cagggtgatg cggcgggtaa ctataccaac 1380
agctttggtg gcaccagcag ctcgtgcccg ggtgcggcgg gtgtggcggc gctgatcatt 1440
gcgcgtaacc cgaacctgcg ttgggaagag gttcgtgaga tcattaagca aagctgcgac 1500
cgtatcgatc aagcaggtgg caactacgat gcgagtggtc atagcccgtt ctacggttat 1560
ggccgtatga acgcgcgtaa ggcggtggaa ctggcgatgc cggagtggcc aagcccggtt 1620
agtatcttta ccatcgtgca ggacgttccg attaaagatc tggaaaccag caccctgacc 1680
ctggcgatcg cgaacaccga cctgatcaag agcattaaag tgagcgttga catcgaacac 1740
ctgcgtatcg gcgatctggt ggttaccctg aaggcgccgg tggagatggg cgttgatccg 1800
atgctgctgc acaaccgtga gggtgcggcg accgacaaca ttaagaaaac ctatgatgta 1860
gtgaacgcgc cgggtctggc ggcgtgcaag ggcaaaagcc cgcagggtac ctggaccctg 1920
gaagttgccg ataaagtgca gcgtgacatt ggcaagatgc gtagctttac cctggaactg 1980
ggctttgagc aaccgagcgg ccaaactggc caccatcacc atcaccatta g   2031

<210> 20
<211> 676
<212> PRT
<213> Artificial Sequence

<220>
<223> Wild type serine endopeptidase from Microcoleus sp. PCC 7113

<400> 20
Met Val Thr Val Arg Tyr Gly Gly Arg Asn Gly Glu Pro Tyr Glu Leu
1   5   10   15
Thr Ile Ser Asp Glu His Ile Val Val Arg Thr Glu Asn Arg Ser Ile
            20   25   30
Leu Thr Glu Thr Arg Pro Tyr Glu Val Thr Ser Val Ser Pro Glu Ala

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        35                  40                  45
Arg Asn Ile Leu Asp Gln Phe Glu Leu Glu Thr Arg Phe Arg Ala Ala
    50                  55                  60
Gly Val Glu Ile Leu Arg Ala Lys Asp Pro Arg Glu Asn Ser Ala Leu
65                  70                  75                  80
Arg Asp Thr Ala Arg Val Ile Leu Asn Gln Glu Pro Ala Ile Gln Phe
                85                  90                  95
Ala Gly Arg Val Leu Val Asp Pro Gln Ser Met Gln Pro Val Val Tyr
            100                 105                 110
Thr Glu Asn Ile Phe Val Lys Phe Asp Asp Glu Thr Gln Ser Gly Ala
        115                 120                 125
Cys Gln Glu Ile Leu Glu Arg Tyr Gly Leu Thr Ile Lys Arg Glu Leu
    130                 135                 140
Gly Tyr Ala Arg Asn Ala Tyr Phe Val Ser Ala Pro Glu Asn Thr Gly
145                 150                 155                 160
Leu Thr Ile Phe Asp Ile Ala Ser Arg Leu Leu Asn Glu Glu Ser Val
                165                 170                 175
Glu Leu Cys His Pro Glu Leu Val Arg Glu Ile Asn Lys Arg Gln Ala
            180                 185                 190
Phe Pro Gln Gln Trp His Leu Lys Pro Thr Thr Ile Arg Gly Gln Ala
        195                 200                 205
Ile Asn Ala Asp Ala Asn Val Glu Ala Ala Trp Ser Leu Ser Asn Gly
    210                 215                 220
Thr Gly Thr Thr Ile Ala Ile Ile Asp Asp Gly Val Asp Leu Asp His
225                 230                 235                 240
Glu Glu Phe Arg Thr Ala Gly Lys Ile Val Ala Pro Arg Asp Val Thr
                245                 250                 255
Arg Lys Thr Asn Asp Pro Arg Pro Gly Asn Arg Asp Asn His Gly Thr
            260                 265                 270
Ala Cys Ala Gly Val Ala Cys Ala Asn Gly Asn Val Gly Ala Ser Gly
        275                 280                 285
Val Ala Pro Gly Ala Arg Leu Met Pro Ile Arg Phe Val Ser Gly Leu
    290                 295                 300
Gly Ser Gln Glu Glu Ala Asp Ala Phe Val Trp Ala Ala Gln Asn Gly
305                 310                 315                 320
Ala Asp Val Ile Ser Cys Ser Trp Gly Pro Pro Asp Gly Val Trp Tyr
                325                 330                 335
Asn Pro Trp Asp Pro Arg His Asn Gln Lys Phe Pro Leu Pro Asp Ser
            340                 345                 350
Thr Arg Leu Ala Met Asp Phe Ala Ile Asn Gln Gly Arg Asn Gly Lys
        355                 360                 365
Gly Cys Val Ile Leu Phe Ala Ala Gly Asn Gly Asn Glu Ser Val Asp
    370                 375                 380
Asn Asp Gly Tyr Ala Ser Tyr Glu Lys Val Ile Ala Val Ala Ala Cys
385                 390                 395                 400
Asn Asp Ser Ser Val Lys Ser Val Tyr Ser Asp Phe Gly Asn Ala Val
                405                 410                 415
Trp Cys Ala Phe Pro Ser Asn Asp Gly Arg Pro Ser Lys Thr Pro Gly
            420                 425                 430
Ile Trp Thr Thr Asp Arg Met Gly Arg Leu Gly Tyr Asn Arg Gly Asn
        435                 440                 445
Leu Arg Gln Gly Asp Ala Ala Gly Asn Tyr Thr Asn Ser Phe Gly Gly
    450                 455                 460
Thr Ser Ser Ser Cys Pro Gly Ala Ala Gly Val Ala Ala Leu Ile Ile
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465                 470                 475                 480
Ala Arg Asn Pro Asn Leu Arg Trp Glu Glu Val Arg Glu Ile Ile Lys
                485                 490                 495
Gln Ser Cys Asp Arg Ile Asp Gln Ala Gly Gly Asn Tyr Asp Ala Ser
            500                 505                 510
Gly His Ser Pro Phe Tyr Gly Tyr Gly Arg Met Asn Ala Arg Lys Ala
        515                 520                 525
Val Glu Leu Ala Met Pro Glu Trp Pro Ser Pro Val Ser Ile Phe Thr
    530                 535                 540
Ile Val Gln Asp Val Pro Ile Lys Asp Leu Glu Thr Ser Thr Leu Thr
545                 550                 555                 560
Leu Ala Ile Ala Asn Thr Asp Leu Ile Lys Ser Ile Lys Val Ser Val
                565                 570                 575
Asp Ile Glu His Leu Arg Ile Gly Asp Leu Val Val Thr Leu Lys Ala
            580                 585                 590
Pro Val Glu Met Gly Val Asp Pro Met Leu Leu His Asn Arg Glu Gly
        595                 600                 605
Ala Ala Thr Asp Asn Ile Lys Lys Thr Tyr Asp Val Val Asn Ala Pro
    610                 615                 620
Gly Leu Ala Ala Cys Lys Gly Lys Ser Pro Gln Gly Thr Trp Thr Leu
625                 630                 635                 640
Glu Val Ala Asp Lys Val Gln Arg Asp Ile Gly Lys Met Arg Ser Phe
                645                 650                 655
Thr Leu Glu Leu Gly Phe Glu Gln Pro Ser Gly Gln Thr Gly His His
            660                 665                 670
His His His His
        675
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<210> 21
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 21
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggactt ccggtgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggttgcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttgataagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtatgggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
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ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg tatggtgcgc actacgaaga tgtgggtggc 1140
gacggccaga cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accctgttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggtt accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 22
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 22
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Glu
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Asp Gly Phe Asn
20 25 30
Asp Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
115 120 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Phe Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ala
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Asp

```
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Met Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Tyr Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Gln Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Leu Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 23
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 23
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tggccggagc tggcggagcg tgcggacggt ttcaacgaca tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagtatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggactt caaatgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
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ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggttgcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttgacaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtatgggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg tatggtgcgc actacgaaga tgtgggtggc 1140
gacggccaga cctacccgat cgatatgccg atcattgagc aactgcacga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggtt accgatgaga acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag                                              1518
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<210> 24
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 24

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Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Glu
1               5                  10                  15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Asp Gly Phe Asn
            20                  25                  30
Asp Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
        115                 120                 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Phe Lys Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
```

```
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ala
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Asp
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Met Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Tyr Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Gln Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu His Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 25
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 25
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atgcgtaacc cgaccctgct gcaatgcttt cactggtact acccggaagg cggtaaactg 60
tggccggagc tggcggagcg tgcggacggt ttcaacgaca tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tataccttтc cggcgcgtgc gggccagtac agccaattta tctgggactt caaatgcttt 480
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agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggttgcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttgacaagc tgcagaccta cattgatcaa 840
gttgagggtt cgaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtatgggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg tatggtgcgc actacgaaga tgtgggtggc 1140
gacggccaga cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accctgttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggtt accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag                                              1518


<210> 26
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 26
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Glu
1               5                  10                  15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Asp Gly Phe Asn
            20                  25                  30
Asp Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
        115                 120                 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Phe Lys Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
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```
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ala
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Asp
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Ser Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Met Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Tyr Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Gln Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Leu Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 27
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 27
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240

gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggactt caaatgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggttgcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttgacaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtatgggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg tatggtgcgc actacgaaga tgtgggtggc 1140
gacggccaga cctacccgat cgatatgccg atcattgagc aactggacga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgacgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcaaga gcgtgtggtt accgatgaga acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 28
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 28
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Glu
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Leu Ala Asp Gly Phe Asn
20 25 30
Asp Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
115 120 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Phe Lys Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys

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                165                 170                 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ala
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Asp
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Met Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Tyr Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Gln Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 29
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 29

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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggactt caaatgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggttgcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggtaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtatgggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg tatggtgcgc actacgaaga tgtgggtggc 1140
gacggccaga cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accctgttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggtt accgatgaaa acggcgaggc gacctttttc 1440
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catcaccatc accattag 1518

<210> 30
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 30
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Glu
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Asp Gly Phe Asn
20 25 30
Asp Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
115 120 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro

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    130                 135                 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Phe Lys Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ala
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Met Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Tyr Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Gln Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Leu Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 31
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 31
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcattg caaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggactt taaatgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggttgcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttgacaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtatgggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcga gctacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accctgttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggtt accgatgaaa acggcgaggc gacctttttc 1440
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catcaccatc accattag 1518

<210> 32
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 32
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Glu
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Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Asp Gly Phe Asn
            20   25   30
Asp Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Ala Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys

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            100                 105                 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
        115                 120                 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Phe Lys Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ala
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Asp
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Met Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala Ser Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Leu Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Asp Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 33

<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 33
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagtatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggactt caaatgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggttgcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttgacaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtatgggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg tatggtgcgc actacgaaga tgtgggtggc 1140
gacggccaga cctacccgat cgatatgccg atcattgagc aactggacga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accctgttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
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tttctgggta accgtgaaga gcgtgtggtt accgatgata acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 34
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 34
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Glu
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Leu Ala Asp Gly Phe Asn
            20   25   30
Asp Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys

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65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
        115                 120                 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Phe Lys Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ala
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Asp
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Met Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Tyr Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Gln Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Leu Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Glu Glu Arg Val Val Thr Asp Asp Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
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500 505

<210> 35
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 35
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggactt caaatgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggttgcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttgacaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtatgggtc gtgactatga tatgacccaa atcttcaccg gcaccctggg ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg tatggtgcgc actacgaaga tgtgggtggc 1140
gacggcttga cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accctgttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggtt accgatgaaa acggcgaggc gacctttttc 1440
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catcaccatc accattag 1518

<210> 36
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 36
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Glu
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Asp Gly Phe Asn
20 25 30
Asp Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala

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        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
        115                 120                 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Phe Lys Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ala
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Asp
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Met Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Gly Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Tyr Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Leu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Leu Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
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465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 37
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 37
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagtatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggactt caaatgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggttgcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttgacaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtatgggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg tatggtgcgc actacgaaga tgtgggtggc 1140
gacggccaga cctacccgat cgacatgccg atcattgagc aactgcacga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgaagaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtgaaga gcgtgtggtt accgatgaga acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag                                              1518
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<210> 38
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 38
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Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Glu
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1               5                   10                  15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Asp Gly Phe Asn
            20                  25                  30
Asp Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
        115                 120                 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Phe Lys Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ala
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Asp
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Met Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Tyr Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Gln Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu His Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Glu Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
```

```
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Glu Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 39
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 39
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggagcg tgcggacggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta taaatgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttgacaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accctgttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag   1518

<210> 40
<211> 505
<212> PRT
<213> Artificial Sequence

<220>

<223> Variant of alpha-amylase from Escherichia coli

<400> 40

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Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1               5                  10                  15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Asp Gly Phe Asn
            20                  25                  30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
        115                 120                 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Lys Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Asp
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Leu Phe Phe Asp His
```

```
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 41
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 41

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tggccggagc tggcggagcg tgcggacggt ttcaacgaca tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggactt caaatgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggttgcggg gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttgacaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtatgggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg tatggtgcgc actacgaaga tgtgggtggc 1140
gacggccaga cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accctgttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggtt accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag                                              1518
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<210> 42
<211> 505

<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 42
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Glu
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Asp Gly Phe Asn
            20   25   30
Asp Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100   105   110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
        115   120   125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130   135   140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Phe Lys Cys Phe
145   150   155   160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165   170   175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180   185   190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195   200   205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210   215   220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225   230   235   240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ala
                245   250   255
Gly Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Asp
            260   265   270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275   280   285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Met Gly Arg
    290   295   300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305   310   315   320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325   330   335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340   345   350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355   360   365
Asp Leu Tyr Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Gln Thr

```
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Leu Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 43
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 43
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atgcgtaacc cgaccctgct gcaatgcttt cactggtact acccggaagg cggtaaactg 60
tggccggagc tggcggagcg tgcggacggt ttcaacgaca tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggactt caaatgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggttgcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttgacaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtatgggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg tatggtgcgc actacgaaga tgtgggtggc 1140
gacggccaga cctacccgat cgaaatgccg atcattgagc aactgcacga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgaagaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggtt accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag                                              1518
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<210> 44
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 44
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Glu
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Asp Gly Phe Asn
20 25 30
Asp Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
115 120 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Phe Lys Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ala
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Asp
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Met Gly Arg
290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
325 330 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr

```
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Tyr Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Gln Thr
    370                 375                 380
Tyr Pro Ile Glu Met Pro Ile Ile Glu Gln Leu His Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Glu Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
```

<210> 45
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 45
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atgcgtaacc cgaccctgct gcaatgcttt cactggtact acccggaagg cggtaaactg 60
tggccggagc tggcggcgct ggcggacggt ttcaacgaca tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggactt caaatgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggttgcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttgacaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtatgggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg tatggtgcgc actacgaaga tgtgggtggc 1140
gacggccaga cctacccgat cgatatgccg atcattgagc aactgcacga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgaagaattt ccgggctgcg ttgtggttat gagcaacggt 1320
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gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcaaga gcgtgtggtt accgatgata acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 46
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 46
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Glu
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Leu Ala Asp Gly Phe Asn
20 25 30
Asp Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
115 120 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Phe Lys Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ala
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Asp
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Met Gly Arg
290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp

305 310 315 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
325 330 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
340 345 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
355 360 365
Asp Leu Tyr Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Gln Thr
370 375 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu His Glu Leu Ile Leu
385 390 395 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
405 410 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Glu Glu Phe Pro Gly
420 425 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
435 440 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
450 455 460
Arg Gln Glu Arg Val Val Thr Asp Asp Asn Gly Glu Ala Thr Phe Phe
465 470 475 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
485 490 495
Gln Thr Gly His His His His His His
500 505

<210> 47
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 47
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggcaggtac agccaattta tctgggactt caaatgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggttgcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttgacaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtatgggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080

ggtgtgccga gcgtgttcta cccggacctg tatggtgcgc actacgaaga tgtgggtggc 1140
gacggccaga cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accctgttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggtt accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 48
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 48
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Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Asp Gly Phe Asn
20 25 30
Asp Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
115 120 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Arg Tyr Ser Gln Phe Ile Trp Asp Phe Lys Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ala
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Asp
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe

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        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Met Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Tyr Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Gln Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Leu Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 49
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 49
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggactt caaatgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttgacaagc tgcagaccta cattgatcaa 840
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gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtatgggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg tatggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accctgttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggtt accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 50
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 50
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Glu
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Asp Gly Phe Asn
20 25 30
Asp Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
115 120 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Phe Lys Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser

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                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Asp
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Met Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Tyr Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Leu Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 51
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 51
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcattc caaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgac gaaatcattg agtgcgaagg ttggacccgt 420
tataccttтc cggcgcgtgc gggccagtac agccaattta tctgggactt taaatgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
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atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttgacaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtatgggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg tacggtgcgc actacgaaga tgtgggtggc 1140
gacggccaga cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accctgttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
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tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
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catcaccatc accattag 1518

<210> 52
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 52
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1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Asp Gly Phe Asn
20 25 30
Asp Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Phe Lys Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met

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    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Asp
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Met Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Tyr Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Gln Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Leu Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Asp Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 53
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 53
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360

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aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggactt caaatgcttt 480
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tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggttgcgga gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttgacaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtatgggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
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gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg tatggtgcgc actacgaaga tgtgggtggc 1140
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gcgcgtcagc gtttcgcgca cggcgttcaa accctgttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
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catcaccatc accattag                                              1518
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<210> 54
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 54

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Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Glu
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Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Asp Gly Phe Asn
            20                  25                  30
Asp Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
        115                 120                 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Phe Lys Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
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            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ala
                245                 250                 255
Glu Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Asp
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Met Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Tyr Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Gln Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Leu Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 55
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 55
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tggccggagc tggcggagcg tgcggacggt ttcaacgaca tcggcattaa catggtgtgg 120

ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggactt taaatgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttgacaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg tacggtgcga gctacgaaga tgtgggtggc 1140
gacggccaga cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accctgttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggagg ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 56
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 56
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Asp Gly Phe Asn
20 25 30
Asp Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
115 120 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Phe Lys Cys Phe

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145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Asp
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Tyr Gly Ala Ser Tyr Glu Asp Val Gly Gly Asp Gly Gln Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Leu Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 57
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 57
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tggccggagc tggcggagcg tgcggacggt ttcaacgata tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcgttc caaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgac gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggactt taaatgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttgacaagc tgcagaccta cattgatcaa 840
gttgatggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg tacggtgcgc actacgaaga tgtgggtggc 1140
gacggccaga cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accctgttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggatg ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 58
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 58
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Glu
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Asp Gly Phe Asn
            20 25 30
Asp Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Val Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
                85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100 105 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile

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        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Phe Lys Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Asp
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Asp Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Tyr Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Gln Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Leu Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Asp Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 59
<211> 1518
<212> DNA

<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 59
atgcgtaacc cgaccctgct gcaatgcttt cactggtact acccggaagg cggtaaactg 60
tggccggagc tggcggagcg tgcggacggt ttcaacgaca tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggactt caaatgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggttgcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttaagaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtatgggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg tatggtgcgc actacgaaga tgtgggtggc 1140
gacggccaga cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accctgttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggtt accgatgaaa acggcgaggc gacctttttc 1440
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catcaccatc accattag 1518

<210> 60
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 60
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Glu
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Asp Gly Phe Asn
            20   25   30
Asp Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala

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                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
        115                 120                 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Phe Lys Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ala
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Lys
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Met Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Tyr Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Gln Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Leu Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 61
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 61
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tggccggagc tggcggagcg tgcggacggt ttcaacgaca tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcgttg caaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggactt caaatgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttgacaagc tgcagaccta cattgatcaa 840
gttgatggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtatgggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattttact gcgtgagaac 1080
ggtgtgccga gcgtgttgta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accctgttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
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catcaccatc accattag 1518

<210> 62
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 62
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Asp Gly Phe Asn
            20   25   30
Asp Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu

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    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Val Ala Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
        115                 120                 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Phe Lys Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Asp
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Asp Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Met Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Leu Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Leu Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Asp Val Ile Gly
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               485                 490                 495
Gln Thr Gly His His His His His His
            500                 505


<210> 63
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 63
atgcgtaacc cgaccctgct gcaatgcttt cactggtact acccggaagg cggtaaactg 60
tggccggagc tggcggagcg tgcggacggt ttcaacgaca tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggactt caaatgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggttgcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttgacaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtatgggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg tatggtgcgc actacgaaga tgtgggtggc 1140
gacggccaga cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa acctcgttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggtt accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag                                              1518


<210> 64
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 64
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Glu
1               5                   10                  15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Asp Gly Phe Asn
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            20                  25                  30
Asp Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
        115                 120                 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Phe Lys Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ala
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Asp
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Met Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Tyr Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Gln Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Ser Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
```

```
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 65
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 65
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tggccggagc tggcggagcg tgcggacggt ttcaacgaca tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggactt caaatgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggttgcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttgacaagc tgcagaccta cattgatcaa 840
gttgagggtc ggaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtatgggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg tatggtgcgc actacgaaga tgtgggtggc 1140
gacggccaga cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accctgttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggtt accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag                                              1518
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<210> 66
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 66
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Glu
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Asp Gly Phe Asn
            20   25   30
Asp Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100   105   110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
        115   120   125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130   135   140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Phe Lys Cys Phe
145   150   155   160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165   170   175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180   185   190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195   200   205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210   215   220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225   230   235   240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ala
                245   250   255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Asp
            260   265   270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Arg Thr Met Leu Phe
        275   280   285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Met Gly Arg
    290   295   300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305   310   315   320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325   330   335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340   345   350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355   360   365
Asp Leu Tyr Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Gln Thr
    370   375   380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385   390   395   400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Leu Phe Phe Asp His
                405   410   415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly

```
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 67
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 67
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atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggagcg tgcggacggt ttcaacgata tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcgttc caaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggactt taaatgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttgacaagc tgcagaccta cattgatcaa 840
gttgatggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cccgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accctgttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggtt accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag                                              1518
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<210> 68
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 68
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Asp Gly Phe Asn
            20   25   30
Asp Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Val Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100   105   110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
        115   120   125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130   135   140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Phe Lys Cys Phe
145   150   155   160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165   170   175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180   185   190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195   200   205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210   215   220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225   230   235   240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245   250   255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Asp
            260   265   270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Asp Gly Lys Thr Met Leu Phe
        275   280   285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290   295   300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305   310   315   320
Pro Phe His Ala Val Thr Leu Val Ala Asn Pro Asp Thr Gln Pro Leu
                325   330   335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340   345   350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355   360   365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370   375   380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu

```
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Leu Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 69
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 69

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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggactt caaatgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggttgcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttagtaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtatgggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg tatggtgcgc actacgaaga tgtgggtggc 1140
gacggccaga cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accctgttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggtt accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag                                              1518
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<210> 70
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 70
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Glu
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Asp Gly Phe Asn
            20   25   30
Asp Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100   105   110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
        115   120   125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130   135   140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Phe Lys Cys Phe
145   150   155   160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165   170   175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180   185   190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195   200   205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210   215   220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225   230   235   240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ala
                245   250   255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Ser
            260   265   270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275   280   285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Met Gly Arg
    290   295   300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305   310   315   320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325   330   335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340   345   350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro

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        355                 360                 365
Asp Leu Tyr Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Gln Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Leu Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 71
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 71
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atgcgtaacc cgaccctgct gcaatgcttt cactggtact acccggaagg cggtaaactg 60
tggccggagc tggcggagcg tgcgaggggt ttcaacgaca tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggactt caaatgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggttgcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttgacaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtatgggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg tatggtgcgc actacgaaga tgtgggtggc 1140
gacggccaga cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accctgttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggtt accgatgaaa acggcgaggc gacctttttc 1440
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tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 72
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 72
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Glu
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Arg Gly Phe Asn
20 25 30
Asp Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
115 120 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Phe Lys Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ala
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Asp
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Met Gly Arg
290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu

```
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Tyr Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Gln Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Leu Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 73
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 73
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atgcgtaacc cgaccctgct gcaatgcttt cactggtact acccggaagg cggtaaactg 60
tggccggagc tggcggagcg tgcggacggt ttcaacgaca tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggactt caaatgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggttgcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttccgaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtatgggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg tatggtgcgc actacgaaga tgtgggtggc 1140
gacggccaga cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
```

gcgcgtcagc gtttcgcgca cggcgttcaa accctgttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggtt accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 74
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 74
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Glu
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Asp Gly Phe Asn
20 25 30
Asp Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
115 120 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Phe Lys Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ala
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Pro
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Met Gly Arg

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    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Tyr Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Gln Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Leu Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 75
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 75
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atgcgtaacc cgaccctgct gcaatgcttt cactggtact acccggaagg cggtaaactg 60
tggccggagc tggcggagcg tgcggacggt ttcaacgaca tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggactt caaatgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggttgcgcg gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttgacaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtatgggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
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ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg tatggtgcgc actacgaaga tgtgggtggc 1140
gacggccaga cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accctgttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggtt accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 76
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 76
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Glu
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Asp Gly Phe Asn
20 25 30
Asp Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
115 120 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Phe Lys Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ala
245 250 255
Arg Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Asp

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            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Met Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Tyr Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Gln Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Leu Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 77
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 77
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atgcgtaacc cgaccctgct gcaatgcttt cactggtact acccggaagg cggtaaactg 60
tggccggagc tggcggagcg tgcggacggt ttcaacgaca tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggactt caaatgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
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ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggttgcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttgacaagc tgcagaccta cattcggcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtatgggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg tatggtgcgc actacgaaga tgtgggtggc 1140
gacggccaga cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accctgttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggtt accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag                                              1518
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<210> 78
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 78

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Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Glu
1               5                  10                  15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Asp Gly Phe Asn
            20                  25                  30
Asp Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
        115                 120                 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Phe Lys Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
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225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ala
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Asp
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Arg Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Met Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Tyr Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Gln Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Leu Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 79
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 79
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tggccggagc tggcggagcg tgcggacggt ttcaacgaca tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tataccttтc cggcgcgtgc gggccagtac agccaattta tctgggactt caaatgcttt 480
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agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggttgcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttaggaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtatgggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg tatggtgcgc actacgaaga tgtgggtggc 1140
gacggccaga cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accctgttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggtt accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 80
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 80
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Glu
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Asp Gly Phe Asn
20 25 30
Asp Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
115 120 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Phe Lys Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg

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        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ala
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Arg
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Met Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Tyr Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Gln Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Leu Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 81
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 81
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240

gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggactt caaatgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggttgcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttgacaagc tgcagaccta cattgatcaa 840
gttgagggtt gtaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtatgggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg tatggtgcgc actacgaaga tgtgggtggc 1140
gacggccaga cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accctgttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggtt accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 82
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 82
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Glu
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Asp Gly Phe Asn
20 25 30
Asp Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
115 120 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Phe Lys Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys

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                165                 170                 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ala
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Asp
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Cys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Met Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Tyr Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Gln Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Leu Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505


<210> 83
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 83
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgac gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggactt taaatgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttgacaagc tgcagcaata cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtatgggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg tacggtgcga gctacgaaga tgtgggtggc 1140
gacggccaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accctgttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtgacg accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggagg ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 84
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 84
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Asp Gly Phe Asn
20 25 30
Asp Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro

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    130                 135                 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Phe Lys Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Asp
            260                 265                 270
Lys Leu Gln Gln Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Met Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Tyr Gly Ala Ser Tyr Glu Asp Val Gly Gly Asp Gly Gln Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Leu Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Thr Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 85
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 85
atgcgtaacc cgaccctgct gcaatgcttt cactggtact acccggaagg cggtaaactg 60
tggccggagc tggcggagcg tgcggacggt ttcaacgaca tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggactt caaatgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggttgcgtc taagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttgacaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
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ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg tatggtgcgc actacgaaga tgtgggtggc 1140
gacggccaga cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accctgttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggtt accgatgaaa acggcgaggc gacctttttc 1440
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catcaccatc accattag 1518

<210> 86
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 86
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Glu
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Asp Gly Phe Asn
            20   25   30
Asp Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys

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            100                 105                 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
        115                 120                 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Phe Lys Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ala
                245                 250                 255
Ser Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Asp
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Met Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Tyr Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Gln Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Leu Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 87

<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 87
atgcgtaacc cgaccctgct gcaatgcttt cactggtact acccggaagg cggtaaactg 60
tggccggagc tggcggagcg tgcggacggt ttcaacgaca tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggactt caaatgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggttgcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttgacaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtatgggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg tatggtgcgc actacgaaga tgtgggtggc 1140
gacggccaga cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggctctcaa accctgttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggtt accgatgaaa acggcgaggc gacctttttc 1440
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catcaccatc accattag 1518

<210> 88
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 88
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Glu
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Asp Gly Phe Asn
            20   25   30
Asp Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys

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65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
        115                 120                 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Phe Lys Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ala
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Asp
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Met Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Tyr Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Gln Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Ser Gln Thr Leu Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
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500 505

<210> 89
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 89
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggactt caaatgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaaa gtgttgcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttgacaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtatgggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg tatggtgcgc actacgaaga tgtgggtggc 1140
gacggccaga cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accctgttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggtt accgatgaaa acggcgaggc gacctttttc 1440
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catcaccatc accattag 1518

<210> 90
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 90
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Glu
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Asp Gly Phe Asn
20 25 30
Asp Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala

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        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
        115                 120                 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Phe Lys Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Ser Val Ala
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Asp
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Met Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Tyr Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Gln Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Leu Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
```

```
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 91
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 91

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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggactt caaatgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggttgcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttgacaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtatgggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg tatggtgcgc actacgaaga tgtgggtggc 1140
gacggccaga cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accctgttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggtt accgatgaaa acggcgaggc gacctttttc 1440
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catcaccatc accattag                                              1518
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<210> 92
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 92

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Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Glu
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Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Asp Gly Phe Asn
            20                  25                  30
Asp Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
        115                 120                 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Phe Lys Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ala
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Asp
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Met Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Tyr Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Gln Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Leu Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
```

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        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Glu Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 93
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 93
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcactatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggactt caaatgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggttgcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttgacaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtatgggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
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gcgcgtcagc gtttcgcgca cggcgttcaa accctgttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
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tttctgggta accgtcagga gcgtgtggtt accgatgata acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag                                              1518
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<210> 94
<211> 505
<212> PRT
<213> Artificial Sequence

<220>

<223> Variant of alpha-amylase from Escherichia coli

<400> 94

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Gly Gly Glu Leu Trp Pro Glu Leu Ala Glu Arg Ala Asp Gly Phe Asn
            20                  25                  30
Asp Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Thr Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
        115                 120                 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Phe Lys Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ala
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Asp
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Met Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Ala Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Tyr Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Gln Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Leu Phe Phe Asp His
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                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Asp Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
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Gln Thr Gly His His His His His His
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<210> 95
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 95
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
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tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
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cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggttgcggt gaagccgctg 780
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catcaccatc accattag                                              1518
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<210> 96
<211> 505

<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

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Asp Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
                85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100 105 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
        115 120 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Phe Lys Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165 170 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ala
                245 250 255
Val Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Asp
            260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Met Gly Arg
    290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325 330 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340 345 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355 360 365
Asp Leu Tyr Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Gln Thr

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    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Leu Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 97
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 97

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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggactt caaatgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggttgcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttgacaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtatgggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
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catcaccatc accattag                                              1518
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<210> 98
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 98
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Glu
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Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Ser Gly Phe Asn
20 25 30
Asp Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
115 120 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Phe Lys Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ala
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Asp
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Met Gly Arg
290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
325 330 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr

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            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Tyr Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Gln Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Leu Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 99
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 99

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ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
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atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttgacaagc tgcagaccta cattgatcaa 840
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gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
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catcaccatc accattag 1518

<210> 100
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 100
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20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Phe Lys Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Asp
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp

305 310 315 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
325 330 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
340 345 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
355 360 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
370 375 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385 390 395 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Leu Phe Phe Asp His
405 410 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
420 425 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
435 440 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
450 455 460
Arg Gln Glu Arg Val Thr Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465 470 475 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
485 490 495
Gln Thr Gly His His His His His His
500 505

<210> 101
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
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cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
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catcaccatc accattag 1518

<210> 102
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 102
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35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
115 120 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Phe Lys Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ala
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Asp
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Tyr Thr Met Leu Phe

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Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Met Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Tyr Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Gln Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Leu Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 103
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 103
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcattc caaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggactt caaatgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttgacaagc tgcagaccta cattgatcaa 840
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gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtatgggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg tatggtgcgc actacgaaga tgtgggtggc 1140
gacggccaga cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accctgttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggtt accgatgaaa acggcgaggc gacctttttc 1440
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catcaccatc accattag 1518

<210> 104
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 104
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Glu
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Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Asp Gly Phe Asn
20 25 30
Asp Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
115 120 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Phe Lys Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser

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                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Asp
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Met Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Tyr Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Gln Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Leu Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 105
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 105
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tataccttтc cggcgcgtgc gggccagtac agccaattta tctgggactt caaatgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
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atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag gtgttgcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttgacaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtatgggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg tatggtgcgc actacgaaga tgtgggtggc 1140
gacggccaga cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accctgttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggtt accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 106
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 106
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20 25 30
Asp Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
115 120 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Phe Lys Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met

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    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Gly Val Ala
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Asp
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Met Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Tyr Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Gln Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Leu Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 107
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 107
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcgttc caaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
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aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggactt taaatgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttgacaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtatgggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
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ggtgtgccga gcgtgttcta cccggacctg tatggtgcgc actacgaaga tgtgggtggc 1140
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gcgcgtcagc gtttcgcgca cggcgttcaa accctgttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
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tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggatg ttatcggcca aactggccac 1500
catcaccatc accattag                                              1518
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<210> 108
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 108

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            20                  25                  30
Asp Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Val Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
        115                 120                 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Phe Lys Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
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            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Asp
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Met Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Tyr Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Gln Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Leu Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Asp Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 109
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 109
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcgttc caaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgac gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggactt caaatgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttgacaagc tgcagaccta cattgatcaa 840
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cgtatgggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
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gacggccaga cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accctgttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
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tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
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catcaccatc accattag 1518

<210> 110
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 110
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Asp Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Val Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Phe Lys Cys Phe

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145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Asp
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Asp Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Met Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala Ser Tyr Glu Asp Val Gly Gly Asp Gly Gln Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Leu Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Asp Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 111
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 111
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggcacttac agccaattta tctgggactt caaatgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggttgcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttgacaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtatgggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
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gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg tatggtgcgc actacgaaga tgtgggtggc 1140
gacggccaga cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accctgttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggtt accgatgaaa acggcgaggc gacctttttc 1440
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catcaccatc accattag 1518

<210> 112
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 112
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Glu
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Asp Gly Phe Asn
            20   25   30
Asp Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100   105   110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile

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        115                 120                 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Ala Arg Ala Gly Thr Tyr Ser Gln Phe Ile Trp Asp Phe Lys Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ala
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Asp
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Met Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Tyr Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Gln Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Leu Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 113
<211> 1518
<212> DNA

<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 113
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggactt caaatgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggttgcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttgacaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtatgggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aagcgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg tatggtgcgc actacgaaga tgtgggtggc 1140
gacggccaga cctacccgat cgaaatgccg atcattgagc aactgcacga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accctgttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgaagaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcaaga gcgtgtggtt accgatgaga acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 114
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 114
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Glu
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Asp Gly Phe Asn
            20 25 30
Asp Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala

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                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
        115                 120                 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Phe Lys Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ala
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Asp
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Met Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Ala Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Tyr Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Gln Thr
    370                 375                 380
Tyr Pro Ile Glu Met Pro Ile Ile Glu Gln Leu His Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Leu Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Glu Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 115
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 115
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggactt caaatgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggttgcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttgacaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtatgggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg tatggtgcgc actacgaaga tgtgggtggc 1140
gacggccaga cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accctgttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggtt accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttctgggcca aactggccac 1500
catcaccatc accattag 1518

<210> 116
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 116
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Glu
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Asp Gly Phe Asn
            20   25   30
Asp Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu

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    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
        115                 120                 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Phe Lys Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ala
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Asp
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Met Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Tyr Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Gln Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Leu Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Leu Gly
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               485                 490                 495
Gln Thr Gly His His His His His His
            500                 505


<210> 117
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 117
atgcgtaacc cgaccctgct gcaatgcttt cactggtact acccggaagg cggtaaactg 60
tggccggagc tggcggagcg tgcggacggt ttcaacgaca tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggactt caaatgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggttgcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttgacaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtatgggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcgcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg tatggtgcgc actacgaaga tgtgggtggc 1140
gacggccaga cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accctgttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggtt accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag                                              1518


<210> 118
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 118
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Glu
1               5                   10                  15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Asp Gly Phe Asn
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            20                  25                  30
Asp Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
        115                 120                 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Phe Lys Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ala
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Asp
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Met Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Tyr Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Gln Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Leu Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
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    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 119
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 119
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggactt caaatgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggttgcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttgacaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaaatttca cgaagcgagc 900
cgtatgggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
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gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg tatggtgcgc actacgaaga tgtgggtggc 1140
gacggccaga cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accctgttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggtt accgatgaaa acggcgaggc gacctttttc 1440
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catcaccatc accattag                                              1518
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<210> 120
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 120
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Glu
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Gly Gly Phe Asn
            20   25   30
Asp Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100   105   110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
        115   120   125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130   135   140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Phe Lys Cys Phe
145   150   155   160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165   170   175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180   185   190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195   200   205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210   215   220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225   230   235   240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ala
                245   250   255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Asp
            260   265   270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275   280   285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Met Gly Arg
    290   295   300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305   310   315   320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325   330   335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340   345   350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355   360   365
Asp Leu Tyr Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Gln Thr
    370   375   380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385   390   395   400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Leu Phe Phe Asp His
                405   410   415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly

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            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 121
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 121
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggactt caaatgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggttgcgcc gaagcagctg 780
tttatcgtgg cggagtattg gagccacgaa gttgacaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtatgggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg tatggtgcgc actacgaaga tgtgggtggc 1140
gacggccaga cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accctgttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggtt accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag                                              1518
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<210> 122
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 122
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Glu
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Asp Gly Phe Asn
            20   25   30
Asp Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100   105   110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
        115   120   125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130   135   140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Phe Lys Cys Phe
145   150   155   160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165   170   175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180   185   190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195   200   205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210   215   220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225   230   235   240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ala
                245   250   255
Pro Lys Gln Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Asp
            260   265   270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275   280   285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Met Gly Arg
    290   295   300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305   310   315   320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325   330   335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340   345   350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355   360   365
Asp Leu Tyr Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Gln Thr
    370   375   380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu

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385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Leu Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 123
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 123
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggactt caaatgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggttgcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttgacaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtatgggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg tatggtgcgc actacgaaga tgtgggtggc 1140
gacggccaga cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accctgttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggtt accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag tttatggcca aactggccac 1500
catcaccatc accattag                                              1518
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<210> 124
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 124
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Glu
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Asp Gly Phe Asn
            20   25   30
Asp Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100   105   110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
        115   120   125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130   135   140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Phe Lys Cys Phe
145   150   155   160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165   170   175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180   185   190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195   200   205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210   215   220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225   230   235   240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ala
                245   250   255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Asp
            260   265   270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275   280   285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Met Gly Arg
    290   295   300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305   310   315   320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325   330   335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340   345   350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro

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        355                 360                 365
Asp Leu Tyr Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Gln Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Leu Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Tyr Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 125
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 125

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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta taagtgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattcgccaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgaggaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
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tgcaacggcg gtagcgtgag cgtgtgggtg attgaggacg ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 126
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 126
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Asp Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
115 120 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Lys Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Arg Gln Val Glu Gly Lys Thr Met Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu

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                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Glu Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Asp Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 127
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 127
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
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tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
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catcaccatc accattag 1518

<210> 128
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 128
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35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
115 120 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Lys Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg

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Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Glu Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
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                485                 490                 495
Gln Thr Gly His His His His His His
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<210> 129
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 129
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ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
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cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
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catcaccatc accattag 1518

<210> 130
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 130
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20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
115 120 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Lys Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly

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            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Asp Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 131
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 131
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ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
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agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
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catcaccatc accattag                                              1518
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<210> 132
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 132

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Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
        115                 120                 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Lys Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
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225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Arg Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu His Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 133
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

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ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
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gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
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tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
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catcaccatc accattag 1518

<210> 134
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 134
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
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20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Lys Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg

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        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Ser Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Asp
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Ser Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala Ser Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Ser Gln Thr Leu Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Glu Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
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<210> 135
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

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ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240

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catcaccatc accattag 1518

<210> 136
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 136
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Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Lys Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys

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                165                 170                 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Asp
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Ser Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala Ser Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Ser Gln Thr Leu Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Asp Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
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<210> 137
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 137

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ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
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atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
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ggtgtgccga gcgtgttcta cccggacctg ttcggtgcga gctacgaaga tgtgggtggc 1140
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catcaccatc accattag 1518

<210> 138
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 138
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
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Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Asp Gly Phe Asn
            20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
                85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100 105 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
        115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro

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    130                 135                 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Lys Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Gly Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Asp
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Ser Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala Ser Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Ser Gln Thr Leu Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Glu Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
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<210> 139
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

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ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
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tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
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cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
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ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc attacgaaga tgtgggtggc 1140
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catcaccatc accattag 1518

<210> 140
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 140
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Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Asp Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys

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            100                 105                 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Ala Arg Ala Gly Arg Tyr Ser Gln Phe Ile Trp Asp Tyr Lys Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Ser Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Asp
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Ser Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Ser Gln Thr Leu Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Glu Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 141

<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 141
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ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
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tatacctttc cggcgcgtgc gggccgttac agccaattta tctgggacta taaatgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
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cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
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catcaccatc accattag 1518

<210> 142
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 142
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
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Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Asp Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys

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65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Ala Arg Ala Gly Arg Tyr Ser Gln Phe Ile Trp Asp Tyr Lys Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Gly Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Asp
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Ser Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Ser Gln Thr Leu Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Glu Glu Arg Val Val Thr Asp Asp Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
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500 505

<210> 143
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 143
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ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
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gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
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tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta taaatgcttt 480
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cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaaa gcgtttcgcc aaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttgacaagc tgcagaccta cattgatcaa 840
gttgagggta gtaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgttccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcagtcaa accctgttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtgagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
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catcaccatc accattag 1518

<210> 144
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 144
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
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Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Asp Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala

```
        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
        115                 120                 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Lys Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Ser Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Asp
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Ser Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Ser Gln Thr Leu Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Glu Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
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465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Glu Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 145
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 145
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tggccggagc tggcggagcg tgcggacggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta taaatgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaaa gcgtttcggg taagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttgacaagc tgcagaccta cattgatcaa 840
gttgagggta gtaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc attacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcagtcaa accctgttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaca acggcgaggc gacctttttc 1440
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catcaccatc accattag                                              1518
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<210> 146
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 146
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Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
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1               5                   10                  15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Asp Gly Phe Asn
            20                  25                  30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
        115                 120                 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Lys Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Ser Val Ser
                245                 250                 255
Gly Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Asp
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Ser Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Ser Gln Thr Leu Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
```

```
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Asp Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 147
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 147
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta taagtgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattcgccaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgaggaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggacg ttatcggcca aactggccac 1500
catcaccatc accattag                                                1518
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<210> 148
<211> 505
<212> PRT
<213> Artificial Sequence

<220>

<223> Variant of alpha-amylase from Escherichia coli

<400> 148

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Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
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Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Asp Gly Phe Asn
            20                  25                  30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
        115                 120                 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Lys Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Arg Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
```

```
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Glu Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Asp Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 149
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 149
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta taagtgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattcgccaa 840
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cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
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ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accgatttct ttgaccaccc gaactgcatc 1260
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tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
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catcaccatc accattag                                              1518
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<210> 150
<211> 505

<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 150
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100   105   110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
        115   120   125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130   135   140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Lys Cys Phe
145   150   155   160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165   170   175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180   185   190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195   200   205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210   215   220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225   230   235   240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245   250   255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260   265   270
Lys Leu Gln Thr Tyr Ile Arg Gln Val Glu Gly Lys Thr Met Leu Phe
        275   280   285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290   295   300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305   310   315   320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325   330   335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340   345   350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355   360   365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr

```
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Asp Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 151
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 151
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta taagtgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
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cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
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cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
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gcgcgtcagc gtttcgcgca cggcgttcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgacgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
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tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
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catcaccatc accattag                                              1518
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<210> 152
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 152
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Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
115 120 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Lys Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
325 330 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr

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            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu His Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
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<210> 153
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 153

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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta taagtgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttgacaagc tgcagaccta cattcgccaa 840
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cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
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gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
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gcgcgtcagc gtttcgcgca cggcgttcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgaggaattt ccgggctgcg ttgtggttat gagcaacggt 1320
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gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
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catcaccatc accattag 1518

<210> 154
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 154
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
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Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
115 120 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Lys Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Asp
260 265 270
Lys Leu Gln Thr Tyr Ile Arg Gln Val Glu Gly Lys Thr Met Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp

305 310 315 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
325 330 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
340 345 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
355 360 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
370 375 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385 390 395 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
405 410 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Glu Glu Phe Pro Gly
420 425 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
435 440 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
450 455 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465 470 475 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
485 490 495
Gln Thr Gly His His His His His His
500 505

<210> 155
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 155
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
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gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080

ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accgatttct ttgaccaccc gaactgcatc 1260
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tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
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catcaccatc accattag 1518

<210> 156
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 156
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
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Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
115 120 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe

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        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 157
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 157
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattcgccaa 840
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cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
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tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
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catcaccatc accattag 1518

<210> 158
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 158
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
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20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
115 120 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser

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                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Arg Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Glu Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Glu Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 159
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 159
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600

atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
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cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
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gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgacgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
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tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
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catcaccatc accattag 1518

<210> 160
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 160
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
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20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
115 120 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met

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    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 161
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 161
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ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360

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agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
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cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
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gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
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catcaccatc accattag                                              1518
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<210> 162
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 162

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Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
        115                 120                 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
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            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Arg Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Arg Leu His Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Glu Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Asp Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 163
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 163
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
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ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgagatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accgatttct ttgaccaccc gaactgcatc 1260
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tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggacg ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 164
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 164
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
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Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Asp Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
115 120 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe

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145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Glu Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Glu Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Asp Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 165
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
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tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
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atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
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catcaccatc accattag 1518

<210> 166
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 166
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Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100   105   110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile

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        115                 120                 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Glu Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
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<210> 167
<211> 1518
<212> DNA

<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

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ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
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aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
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atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
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gcgcgtcagc gtttcgcgca cggcgttcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgaggaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
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catcaccatc accattag 1518

<210> 168
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 168
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Asp Gly Phe Asn
            20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala

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                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
        115                 120                 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Asp
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Arg Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Glu Met Pro Ile Ile Glu Gln Leu His Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Glu Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 169
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 169
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tggccggagc tggcggagcg tgcggacggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta taaatgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc aaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttgacaagc tgcagaccta cattgatcaa 840
gttgagggta gtaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc attacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcagtcaa accctgttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaca acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 170
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 170
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Asp Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu

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    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
        115                 120                 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Lys Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Asp
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Ser Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Ser Gln Thr Leu Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Asp Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
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               485                 490                 495
Gln Thr Gly His His His His His His
            500                 505


<210> 171
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 171
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccgttac agccaattta tctgggacta taaatgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcggg taagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttgacaagc tgcagaccta cattgatcaa 840
gttgagggta gtaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc attacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcagtcaa accctgttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtgagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag                                              1518


<210> 172
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 172
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1               5                   10                  15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Asp Gly Phe Asn
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            20                  25                  30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
        115                 120                 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Ala Arg Ala Gly Arg Tyr Ser Gln Phe Ile Trp Asp Tyr Lys Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Gly Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Asp
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Ser Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Ser Gln Thr Leu Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
```

```
    450                 455                 460
Arg Glu Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 173
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 173
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
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catcaccatc accattag                                              1518
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<210> 174
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 174
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1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100   105   110
Glu His Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
        115   120   125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130   135   140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145   150   155   160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165   170   175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180   185   190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195   200   205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210   215   220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225   230   235   240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245   250   255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260   265   270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275   280   285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290   295   300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305   310   315   320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325   330   335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340   345   350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355   360   365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370   375   380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385   390   395   400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405   410   415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly

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            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 175
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 175
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
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catcaccatc accattag                                              1518
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<210> 176
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 176
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
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Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
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Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100   105   110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
        115   120   125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130   135   140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145   150   155   160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165   170   175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180   185   190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195   200   205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210   215   220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225   230   235   240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245   250   255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260   265   270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275   280   285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290   295   300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305   310   315   320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325   330   335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340   345   350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355   360   365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370   375   380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu

385 390 395 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
405 410 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
420 425 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
435 440 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
450 455 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465 470 475 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
485 490 495
Gln Thr Gly His His His His His His
500 505

<210> 177
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 177
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ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacccggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
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catcaccatc accattag 1518

<210> 178
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 178
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            20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
                85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100 105 110
Glu Ala Ile Arg Val Gln Arg Val Asn Pro Asp Asp Arg Thr Gln Ile
        115 120 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165 170 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325 330 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340 345 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro

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        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 179
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 179
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ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacatttg gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
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cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
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tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
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tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 180
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 180
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
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20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
115 120 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Trp Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu

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                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 181
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 181

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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
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atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
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gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
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gcgcgtcagc gtttcgcgca cggcgttcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
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catcaccatc accattag 1518

<210> 182
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 182
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20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
115 120 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg

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Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 183
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 183
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ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
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gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
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agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
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tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
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<210> 184
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 184
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Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu Ala Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Ile
115 120 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly

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            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 185
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 185
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
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ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
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cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
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tttctgggtt tgcgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
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catcaccatc accattag                                              1518
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<210> 186
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 186

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Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
        115                 120                 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
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225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
325 330 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
340 345 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
355 360 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
370 375 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385 390 395 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
405 410 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
420 425 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
435 440 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Leu
450 455 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465 470 475 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
485 490 495
Gln Thr Gly His His His His His His
500 505

<210> 187
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tataccttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480

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atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
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catcaccatc accattag                                              1518
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<210> 188
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 188

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Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
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Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20                  25                  30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
        115                 120                 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Glu Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
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        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 189
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 189
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240

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gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggaccaag 420
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agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
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cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
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catcaccatc accattag                                              1518
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<210> 190
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 190

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            20                  25                  30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
        115                 120                 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Lys Tyr Thr Phe Pro
    130                 135                 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
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                165                 170                 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 191
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 191

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tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
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tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
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<210> 192
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 192
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
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20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
115 120 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro

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    130                 135                 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Thr Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
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<210> 193
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggaca ggcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
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atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
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ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
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gcgcgtcagc gtttcgcgca cggcgttcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
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catcaccatc accattag 1518

<210> 194
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 194
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Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys

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            100                 105                 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Arg Arg Thr Gln Ile
        115                 120                 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 195

<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagcaggaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
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gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
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catcaccatc accattag 1518

<210> 196
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 196
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
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Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys

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65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Gln
            100                 105                 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
        115                 120                 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
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500 505

<210> 197
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 197
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
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tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
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atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
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tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
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catcaccatc accattag 1518

<210> 198
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 198
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20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala

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        35                  40                  45
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    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
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465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 199
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 199

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cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
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catcaccatc accattag                                              1518
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<210> 200
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 200

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            20                  25                  30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ser Gly Arg Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
        115                 120                 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
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        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 201
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 201
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcaggctta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
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catcaccatc accattag                                              1518
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<210> 202
<211> 505
<212> PRT
<213> Artificial Sequence

<220>

<223> Variant of alpha-amylase from Escherichia coli

<400> 202

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1               5                  10                  15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20                  25                  30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
        115                 120                 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Ala Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
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```
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 203
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 203
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gctaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
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catcaccatc accattag                                              1518
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<210> 204
<211> 505

<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 204
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Ala Lys
            100   105   110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
        115   120   125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130   135   140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145   150   155   160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165   170   175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180   185   190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195   200   205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210   215   220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225   230   235   240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245   250   255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260   265   270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275   280   285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290   295   300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305   310   315   320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325   330   335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340   345   350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355   360   365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr

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    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 205
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 205
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca catggcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
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gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
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gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag                                              1518
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<210> 206
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 206
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Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
115 120 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Met Ala Ser Arg Gln Gly Arg
290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
325 330 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr

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            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 207
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 207

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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
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cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
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gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
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tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
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catcaccatc accattag 1518

<210> 208
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 208
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20 25 30
Glu Ile Gly Ile Arg Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
115 120 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp

305 310 315 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
325 330 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
340 345 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
355 360 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
370 375 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385 390 395 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
405 410 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
420 425 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
435 440 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
450 455 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465 470 475 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
485 490 495
Gln Thr Gly His His His His His His
500 505

<210> 209
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 209
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccgtgg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080

ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 210
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 210
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
115 120 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Val Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe

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        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 211
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 211
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatttg 840
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gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 212
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 212
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
115 120 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser

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                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Leu Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 213
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 213

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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tataccttтc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaaa ggggtaactt cgactacctg 600
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atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 214
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 214
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
115 120 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Arg Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met

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    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 215
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 215
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360

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aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaagta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag                                              1518
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<210> 216
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 216

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            20                  25                  30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
        115                 120                 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
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            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Lys Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 217
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 217
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120

ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac attgatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 218
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 218
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
115 120 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe

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145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Ile Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 219
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 219
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaag agggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 220
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 220
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100   105   110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile

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        115                 120                 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Glu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 221
<211> 1518
<212> DNA

<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 221
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca caaggcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 222
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 222
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala

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                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
        115                 120                 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Lys Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 223
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 223
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aacccagacg atcgtaccca aatcgatgaa gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga aaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggtg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgttccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggctcgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
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catcaccatc accattag 1518

<210> 224
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 224
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu

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    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Pro Asp Asp Arg Thr Gln Ile
        115                 120                 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Ser Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
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               485                 490                 495
Gln Thr Gly His His His His His His
            500                 505


<210> 225
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 225
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca aatcgatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga aaacccggac attgatggca tcttcaagat tgtgaacgac 540
tataccggtg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggctcgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag                                              1518


<210> 226
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 226
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1               5                   10                  15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
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            20                  25                  30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Ile
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Ile Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Ser Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
```

```
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 227
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 227
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgaa gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggtg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgttccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag                                              1518
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<210> 228
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 228
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100   105   110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115   120   125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130   135   140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145   150   155   160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165   170   175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180   185   190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195   200   205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210   215   220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225   230   235   240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245   250   255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260   265   270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275   280   285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290   295   300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305   310   315   320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325   330   335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340   345   350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355   360   365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370   375   380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385   390   395   400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405   410   415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly

```
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 229
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 229
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atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgaa gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggtg agggctggaa cgatcaggtt gacgatgaac gcggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgttccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggctcgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag                                              1518
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<210> 230
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 230
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100   105   110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115   120   125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130   135   140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145   150   155   160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165   170   175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180   185   190
Glu Arg Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195   200   205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210   215   220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225   230   235   240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245   250   255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260   265   270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275   280   285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290   295   300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305   310   315   320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325   330   335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340   345   350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355   360   365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370   375   380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu

```
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Ser Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 231
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 231
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atgcgcaacc cgaccctgct gcaatgtttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagct gcaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttataaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaaa tgaattttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
gtaaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag                                              1518
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<210> 232
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 232
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100   105   110
Glu His Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
        115   120   125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130   135   140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145   150   155   160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165   170   175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180   185   190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195   200   205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210   215   220
Glu Gln Leu Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225   230   235   240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245   250   255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260   265   270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275   280   285
Asp Ala Pro Leu Gln Met Asn Phe His Glu Ala Ser Arg Gln Gly Arg
    290   295   300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305   310   315   320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325   330   335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340   345   350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro

```
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Val Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 233
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 233
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg gtggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttataaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgagtcaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc agctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
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gtaaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 234
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 234
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
115 120 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
290 295 300
Asp Tyr Asp Met Ser Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu

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                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Val Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 235
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 235
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggtg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
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gcgcgtcagc gtttcgcgca cggcgttcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 236
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 236
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
115 120 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg

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    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 237
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 237
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
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ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggctcgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 238
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 238
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
115 120 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly

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            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Ser Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 239
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 239
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
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ccggcgtggt tttataaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttacg 1440
gtaaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 240
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 240
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
115 120 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile

225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
325 330 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
340 345 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
355 360 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
370 375 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385 390 395 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
405 410 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
420 425 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
435 440 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
450 455 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Thr
465 470 475 480
Val Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
485 490 495
Gln Thr Gly His His His His His His
500 505

<210> 241
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 241
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagc gtggacccgt 420
tataccttтc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480

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agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
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atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttataaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaaa tgaattttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
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catcaccatc accattag                                              1518
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<210> 242
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 242

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            20                  25                  30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
        115                 120                 125
Asp Glu Glu Ile Ile Glu Cys Glu Ala Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
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        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Asn Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 243
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 243
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240

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gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagc gtggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagct gcaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttataaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaaa tgaaatttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccc atcattgagg agctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttccg 1440
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catcaccatc accattag                                              1518
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<210> 244
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 244

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1               5                  10                  15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20                  25                  30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
        115                 120                 125
Asp Glu Glu Ile Ile Glu Cys Glu Ala Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
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                165                 170                 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Leu Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Glu Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Pro
465                 470                 475                 480
Val Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 245
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 245

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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgttccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
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tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
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catcaccatc accattag 1518

<210> 246
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 246
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1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
115 120 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro

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    130                 135                 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 247
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 247
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg gtggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac tcaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaaa tgaattttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
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gcgcgtcagc gtttcgcgca cggcgttcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
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catcaccatc accattag 1518

<210> 248
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 248
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys

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            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
        115                 120                 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Asn Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Glu Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 249

<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 249
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
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gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
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gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
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tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
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catcaccatc accattag 1518

<210> 250
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 250
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
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Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys

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65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
        115                 120                 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
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500 505

<210> 251
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 251
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aacccagacg atcgtaccca aatcgatgaa gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgttccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 252
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 252
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala

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        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Pro Asp Asp Arg Thr Gln Ile
        115                 120                 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
```

```
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 253
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 253

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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aacccagacg atcgtaccca aatcgatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac gcggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag                                              1518
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<210> 254
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 254

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Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
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1               5                   10                  15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20                  25                  30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Pro Asp Asp Arg Thr Gln Ile
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Arg Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
```

```
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 255
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 255
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aacccagacg atcgtaccca aatcgatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac gcggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
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gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag                                              1518
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<210> 256
<211> 505
<212> PRT
<213> Artificial Sequence

<220>

<223> Variant of alpha-amylase from Escherichia coli

<400> 256

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Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20                  25                  30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Pro Asp Asp Arg Thr Gln Ile
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Arg Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
```

```
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 257
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 257
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca aatcgatgaa gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga aaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggtg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
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tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
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catcaccatc accattag                                              1518
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<210> 258
<211> 505

<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 258
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Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100   105   110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Ile
        115   120   125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130   135   140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145   150   155   160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165   170   175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180   185   190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195   200   205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210   215   220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225   230   235   240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245   250   255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260   265   270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275   280   285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290   295   300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305   310   315   320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325   330   335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340   345   350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355   360   365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr

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    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 259
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 259

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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca aatcgatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacatttg gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac gcggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgttccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggctcgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
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catcaccatc accattag                                              1518
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<210> 260
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 260
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Ile
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Trp Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Arg Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
325 330 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr

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            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Ser Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 261
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 261

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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca aatcgatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga aaacccggac attgatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
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gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
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gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
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catcaccatc accattag 1518

<210> 262
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 262
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
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Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Ile
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Ile Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp

305 310 315 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
325 330 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
340 345 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
355 360 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
370 375 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385 390 395 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
405 410 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
420 425 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
435 440 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
450 455 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465 470 475 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
485 490 495
Gln Thr Gly His His His His His His
500 505

<210> 263
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 263
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca aatcgatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga aaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggtg agggctggaa cgatcaggtt gacgatgaac gcggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
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gcgcgtcagc gtttcgcgca cggcgttcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
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catcaccatc accattag 1518

<210> 264
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 264
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Ile
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Arg Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe

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        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 265
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 265
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca aatcgatgaa gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacatttg gaacccggac attgatggca tcttcaagat tgtgaacgac 540
tataccggtg agggctggaa cgatcaggtt gacgatgaac gcggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
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gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
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ccgttccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
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tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
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catcaccatc accattag 1518

<210> 266
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 266
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
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Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Ile
115 120 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Trp Asn Pro Asp Ile Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Arg Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser

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                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 267
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 267
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca aatcgatgaa gaaatcattg agtgcgaagg ttggacccgt 420
tataccttтc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacatttg gaacccggac attgatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac gcggtaactt cgactacctg 600
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atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
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catcaccatc accattag 1518

<210> 268
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 268
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
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Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Ile
115 120 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Trp Asn Pro Asp Ile Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Arg Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met

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    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 269
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 269
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360

aaccgcgacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga aaacccggac attgatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac gcggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgttccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggctcgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 270
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 270
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
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Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Ile
115 120 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Ile Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp

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            180                 185                 190
Glu Arg Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Ser Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 271
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 271
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacatttg gaacccggac attgatggca tcttcaagat tgtgaacgac 540
tataccggtg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
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catcaccatc accattag 1518

<210> 272
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 272
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
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Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe

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145                 150                 155                 160
Ser Gly Ile Asp His Ile Trp Asn Pro Asp Ile Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Ser Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 273
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 273
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga aaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggtg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 274
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 274
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp

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        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 275
<211> 1518
<212> DNA

<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 275
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 276
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 276
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala

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                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 277
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 277
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggtg agggctggaa cgatcaggtt gacgatgaac gcggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgttccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 278
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 278
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu

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    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Arg Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
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               485                 490                 495
Gln Thr Gly His His His His His His
            500                 505


<210> 279
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 279
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgaa gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga aaacccggac attgatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac gcggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag                                              1518


<210> 280
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 280
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1               5                   10                  15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
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            20                  25                  30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Ile Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Arg Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
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    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 281
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 281
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgaa gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgttccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggctcgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
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catcaccatc accattag                                              1518
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<210> 282
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 282
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
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Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100   105   110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115   120   125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130   135   140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145   150   155   160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165   170   175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180   185   190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195   200   205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210   215   220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225   230   235   240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245   250   255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260   265   270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275   280   285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290   295   300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305   310   315   320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325   330   335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340   345   350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355   360   365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370   375   380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385   390   395   400
Ala Arg Gln Arg Phe Ala His Gly Ser Gln Thr Asp Phe Phe Asp His
                405   410   415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly

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            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 283
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 283
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aacgcagacg atcgtaccca aatcgatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga aaacccggac attgatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggctcgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
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tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
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catcaccatc accattag                                              1518
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<210> 284
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 284
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100   105   110
Glu His Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
        115   120   125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130   135   140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145   150   155   160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Ile Asp Gly Ile Phe Lys
                165   170   175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180   185   190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195   200   205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210   215   220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225   230   235   240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245   250   255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260   265   270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275   280   285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290   295   300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305   310   315   320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325   330   335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340   345   350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355   360   365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370   375   380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu

385 390 395 400
Ala Arg Gln Arg Phe Ala His Gly Ser Gln Thr Asp Phe Phe Asp His
405 410 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
420 425 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
435 440 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
450 455 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465 470 475 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
485 490 495
Gln Thr Gly His His His His His His
500 505

<210> 285
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 285
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacatttg gaacccggac attgatggca tcttcaagat tgtgaacgac 540
tataccggtg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
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gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 286
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 286
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
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Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
        115 120 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Trp Asn Pro Asp Ile Asp Gly Ile Phe Lys
                165 170 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325 330 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340 345 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro

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        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 287
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 287

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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
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agcggtatcg atcacatttg gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggtg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
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cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
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ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
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tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 288
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 288
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Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
115 120 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Trp Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu

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                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 289
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 289
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacatttg gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac gcggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
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gcgcgtcagc gtttcgcgca cggcgttcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 290
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 290
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
115 120 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Trp Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Arg Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg

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    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 291
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 291
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
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ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
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catcaccatc accattag 1518

<210> 292
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 292
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
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Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
115 120 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly

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            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 293
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 293
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
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ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgttccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
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catcaccatc accattag 1518

<210> 294
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 294
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
115 120 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile

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225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 295
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 295
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aacgcagacg atcgtaccca aatcgatgaa gaaatcattg agtgcgaagg ttggacccgt 420
tataccttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
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agcggtatcg atcacattga aaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
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cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
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gcgcgtcagc gtttcgcgca cggctcgcaa accgatttct ttgaccaccc gaactgcatc 1260
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tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
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catcaccatc accattag 1518

<210> 296
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 296
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
115 120 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg

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        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Ser Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 297
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 297
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240

gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac gcggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
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gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
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gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
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catcaccatc accattag 1518

<210> 298
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 298
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
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20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
115 120 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys

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                165                 170                 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Arg Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 299
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 299

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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
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tataccggtg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
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cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
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gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
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catcaccatc accattag 1518

<210> 300
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 300
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
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Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
115 120 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro

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    130                 135                 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
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Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Ser Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 301
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 301
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
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cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
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ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
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catcaccatc accattag 1518

<210> 302
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 302
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
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Gly Gly Lys Leu Trp Pro Glu Val Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys

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            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
        115                 120                 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 303

<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

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ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
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gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
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tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
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catcaccatc accattag 1518

<210> 304
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 304
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            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys

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65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
        115                 120                 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Glu Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
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500 505

<210> 305
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

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ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
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cgttgggtta tggaacagct gcaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
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tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 306
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 306
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala

```
        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
        115                 120                 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Leu Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
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```
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 307
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 307
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
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catcaccatc accattag                                              1518
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<210> 308
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 308
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Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
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Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20                  25                  30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
```

```
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 309
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 309
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
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ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
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tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag                                              1518
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<210> 310
<211> 505
<212> PRT
<213> Artificial Sequence

<220>

<223> Variant of alpha-amylase from Escherichia coli

<400> 310

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Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
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Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20                  25                  30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Asn Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
```

```
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 311
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 311
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
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catcaccatc accattag                                              1518
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<210> 312
<211> 505

<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 312
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
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Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100   105   110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115   120   125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130   135   140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145   150   155   160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165   170   175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180   185   190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195   200   205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210   215   220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225   230   235   240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245   250   255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260   265   270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275   280   285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290   295   300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305   310   315   320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325   330   335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340   345   350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355   360   365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr

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    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Ser Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 313
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 313

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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
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gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
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tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggttgcgcc gaagccgctg 780
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catcaccatc accattag                                              1518
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<210> 314
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 314
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Glu
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Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Asp Gly Phe Asn
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Asp Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100   105   110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115   120   125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130   135   140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145   150   155   160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165   170   175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180   185   190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195   200   205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210   215   220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225   230   235   240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ala
                245   250   255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260   265   270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275   280   285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Met Gly Arg
    290   295   300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305   310   315   320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325   330   335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr

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            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 315
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 315

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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
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cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
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gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
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tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
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catcaccatc accattag 1518

<210> 316
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 316
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Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp

305 310 315 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
325 330 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Arg Leu Ala Tyr
340 345 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
355 360 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
370 375 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385 390 395 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
405 410 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
420 425 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
435 440 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
450 455 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465 470 475 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
485 490 495
Gln Thr Gly His His His His His His
500 505

<210> 317
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

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ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgtgacg atcgtaccca aattgatgat gaaatcattg agtgcgaagg ttggacccgt 420
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agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggttgcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggtaagc tgcagaccta cattgatcaa 840
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cgtcagggtc gtgactatga tatgtcgcaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcacacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080

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catcaccatc accattag 1518

<210> 318
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 318
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Glu
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Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Asp Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Ile
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ala
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe

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        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Ser Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Gln Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 319
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 319
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
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aacgcggacg atcgtaccca atgggatgag gaaatcattg agtgcgaagg ttggacccgt 420
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atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggttgcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttgataagc tgcagaccta cattgatcaa 840
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catcaccatc accattag 1518

<210> 320
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 320
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20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Trp
115 120 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ala

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                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Asp
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Ser Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Glu Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 321
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 321
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ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
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tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
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catcaccatc accattag 1518

<210> 322
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 322
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
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20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
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Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met

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Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
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Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ala
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Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Asp
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Met Gly Arg
    290                 295                 300
Asp Tyr Asp Met Ser Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
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Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Val Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
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Gln Thr Gly His His His His His His
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<210> 323
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 323
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ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360

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agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
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ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
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catcaccatc accattag                                              1518
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<210> 324
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 324

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Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
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Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
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            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 325
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 325
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgtgacg atcgtaccca atgggatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggggcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggtaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
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ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
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catcaccatc accattag 1518

<210> 326
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 326
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
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Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe

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145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Met Gly Arg
    290                 295                 300
Asp Tyr Asp Met Ser Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 327
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 327
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ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
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cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
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catcaccatc accattag 1518

<210> 328
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 328
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Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Arg Gly Phe Asn
            20   25   30
Asp Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100   105   110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp

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        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Ser Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Gln Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 329
<211> 1518
<212> DNA

<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 329
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catcaccatc accattag 1518

<210> 330
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 330
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
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Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala

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                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Met Gly Arg
    290                 295                 300
Asp Tyr Asp Met Ser Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 331
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 331
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgtgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggggcgtgc gggccagtac agccaattta tctgggactt tcgttgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggttgcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtatgggtc gtgactatga tatgacgcaa atcttcaccg gcaccctggt ggaagcggac 960
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ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
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gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
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catcaccatc accattag 1518

<210> 332
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 332
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Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Asp Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu

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    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Phe Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ala
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Met Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Val Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
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               485                 490                 495
Gln Thr Gly His His His His His His
            500                 505


<210> 333
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 333
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgtgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggggcgtgc gggccagtac agccaattta tctgggactt tcgttgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggtg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggttgcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcagggtc gtgactatga tatgtcgcaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcacacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggccaga cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
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catcaccatc accattag                                              1518


<210> 334
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 334
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1               5                   10                  15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Asp Gly Phe Asn
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            20                  25                  30
Asp Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Phe Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ala
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Ser Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Gln Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
```

```
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 335
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 335
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgtgacg atcgtaccca atgggatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggggcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggttgcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttgataagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
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gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg tacggtgcgc actacgaaga tgtgggtggc 1140
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catcaccatc accattag                                              1518
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<210> 336
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 336
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1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Asp Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100   105   110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115   120   125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130   135   140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145   150   155   160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165   170   175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180   185   190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195   200   205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210   215   220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225   230   235   240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ala
                245   250   255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Asp
            260   265   270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275   280   285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290   295   300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305   310   315   320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325   330   335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340   345   350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355   360   365
Asp Leu Tyr Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370   375   380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Glu Leu Asp Glu Leu Ile Leu
385   390   395   400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405   410   415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly

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            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 337
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 337
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
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aaccgtgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
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tataccggtg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
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cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
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catcaccatc accattag                                              1518
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<210> 338
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 338
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Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100   105   110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115   120   125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130   135   140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145   150   155   160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165   170   175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180   185   190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195   200   205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210   215   220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225   230   235   240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ala
                245   250   255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260   265   270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275   280   285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290   295   300
Asp Tyr Asp Met Ser Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305   310   315   320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325   330   335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340   345   350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355   360   365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Gln Thr
    370   375   380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu

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385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 339
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 339
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgtgacg atcgtaccca atgggatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggggcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggttgcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttgataagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
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gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg tacggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaga cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
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tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
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catcaccatc accattag                                              1518
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<210> 340
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 340
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
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            20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115 120 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ala
                245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Asp
            260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325 330 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340 345 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro

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        355                 360                 365
Asp Leu Tyr Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 341
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 341
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgtgacg atcgtaccca atgggatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggggcgtgc gggccagtac agccaattta tctgggacta taagtgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggtg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggtaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcacacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggccaga cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
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catcaccatc accattag 1518

<210> 342
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 342
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
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Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Lys Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu

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                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Gln Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 343
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 343

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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggggcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
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tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
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ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
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gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
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catcaccatc accattag 1518

<210> 344
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 344
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20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Met Gly Arg

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    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 345
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 345
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
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aaccgtgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
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atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcagggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
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gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
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catcaccatc accattag 1518

<210> 346
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 346
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Asp Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Lys Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly

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            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Gln Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Glu Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 347
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 347
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgtgacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggggcgtgc gggccagtac agccaattta tctgggacta tcgttgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
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cgtatgggtc gtgactatga tatgtcgcaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg tacggtgcgc actacgaaga tgtgggtggc 1140
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tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
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catcaccatc accattag 1518

<210> 348
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 348
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20 25 30
Asp Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Ile
115 120 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile

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225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Met Gly Arg
    290                 295                 300
Asp Tyr Asp Met Ser Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Tyr Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 349
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 349
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgtgacg atcgtaccca atgggatgag gaaatcattg agtgcgaagg ttggacccgt 420
tataccttc cggggcgtgc gggccagtac agccaattta tctgggactt taagtgcttt 480

agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggtg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggtaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcacacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg aactggatga actgattctg 1200
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tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
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catcaccatc accattag 1518

<210> 350
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 350
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
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Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Asp Gly Phe Asn
20 25 30
Asp Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Phe Lys Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg

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        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Glu Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 351
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 351
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240

gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggggcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
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tataccggtg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
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catcaccatc accattag 1518

<210> 352
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 352
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
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20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys

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                165                 170                 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
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Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Met Gly Arg
    290                 295                 300
Asp Tyr Asp Met Ser Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Leu Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 353
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 353

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ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
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catcaccatc accattag 1518

<210> 354
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 354
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Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Trp
        115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro

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    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Lys Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Gln Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
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<210> 355
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 355
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggggcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttgataagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtatgggtc gtgactatga tatgacgcaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
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ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
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gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
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tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
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catcaccatc accattag 1518

<210> 356
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 356
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Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Arg Gly Phe Asn
            20   25   30
Asp Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys

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            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Asp
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Met Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Val Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 357

<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 357
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggggcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttgataagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcagggtc gtgactatga tatgtcgcaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcacacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaga cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accctgttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
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tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
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catcaccatc accattag 1518

<210> 358
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 358
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Asp Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys

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65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Asp
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Ser Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Leu Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
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500 505

<210> 359
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 359
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagggg 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
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catcaccatc accattag 1518

<210> 360
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 360
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
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Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala

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        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Gly Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
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465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 361
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 361
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
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aaccgtgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
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cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
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catcaccatc accattag                                              1518
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<210> 362
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 362
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            20                  25                  30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Ser Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Glu Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
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        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
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Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
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<210> 363
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 363
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ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
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tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
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catcaccatc accattag                                              1518
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<210> 364
<211> 505
<212> PRT
<213> Artificial Sequence

<220>

<223> Variant of alpha-amylase from Escherichia coli

<400> 364

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Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20                  25                  30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Ala Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
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                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
```

<210> 365
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 365
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggggcgtgc gggccagtac agccaattta tctgggacta tcgttgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcagggtc gtgactatga tatgtcgcaa atcttcaccg gcaccctggt ggaagcggac 960
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ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggccaga cctacccgat cgacatgccg atcattgagg aactggatga actgattctg 1200
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tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
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catcaccatc accattag                                              1518
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<210> 366
<211> 505

<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 366
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Glu
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Arg Gly Phe Asn
            20   25   30
Asp Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100   105   110
Glu Ala Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115   120   125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130   135   140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145   150   155   160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165   170   175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180   185   190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195   200   205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210   215   220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225   230   235   240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245   250   255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260   265   270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275   280   285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290   295   300
Asp Tyr Asp Met Ser Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305   310   315   320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325   330   335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340   345   350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355   360   365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Gln Thr

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    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Glu Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 367
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 367
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aaccgtgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggggcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
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<210> 368
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 368
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20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu Ala Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
325 330 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr

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            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 369
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 369

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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
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cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
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gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
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tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
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catcaccatc accattag 1518

<210> 370
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 370
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20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Asp
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp

305 310 315 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
325 330 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
340 345 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
355 360 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
370 375 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385 390 395 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
405 410 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
420 425 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
435 440 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
450 455 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465 470 475 480
Val Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
485 490 495
Gln Thr Gly His His His His His His
500 505

<210> 371
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 371
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080

ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgatga accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 372
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 372
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe

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        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Met Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 373
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 373
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gactcacgaa gttggcaagc tgcagaccta cattgatcaa 840
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gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 374
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 374
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser

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                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Thr His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 375
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 375
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
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atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacacgg gtagcgtgag cgtgtgggtg attgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 376
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 376
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met

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    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Thr Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 377
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 377
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cagtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360

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aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag                                              1518
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<210> 378
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 378

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Gly Ser Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20                  25                  30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
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            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
```

<210> 379
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 379
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120

ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
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cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
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catcaccatc accattag 1518

<210> 380
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 380
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Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe

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Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Ser Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Gln Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 381
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gagcaactgc tggcggcgat cgatgcgctg catcgcaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
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tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccagtgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaaaccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
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ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
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catcaccatc accattag 1518

<210> 382
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 382
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
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Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Glu Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100   105   110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp

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        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Asp Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Leu Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 383
<211> 1518
<212> DNA

<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gagcaactgc tggcggcgat cgatgcgctg catcgcaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccagtgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaaagatctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
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ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
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catcaccatc accattag 1518

<210> 384
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 384
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
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Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Glu Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala

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                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Asp Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 385
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

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ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
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tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
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tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
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catcaccatc accattag 1518

<210> 386
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 386
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
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Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu

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    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Asp Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
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               485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 387
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 387
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ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
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aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
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atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
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catcaccatc accattag                                              1518
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<210> 388
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 388
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Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
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Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Ala Gly Phe Asn
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            20                  25                  30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
```

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    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 389
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 389
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaca acggcgaggc gacctttttc 1440
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catcaccatc accattag                                              1518
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<210> 390
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 390
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100   105   110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115   120   125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130   135   140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145   150   155   160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165   170   175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180   185   190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195   200   205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210   215   220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225   230   235   240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245   250   255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260   265   270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275   280   285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290   295   300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305   310   315   320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325   330   335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340   345   350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355   360   365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370   375   380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385   390   395   400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405   410   415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly

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            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Asp Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 391
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 391
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgcaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccagtgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaaagatctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
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cgtcaaggtc gtgactatga tatgacccaa atcttcgacg gcaccctggt ggaagcggac 960
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catcaccatc accattag                                              1518
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<210> 392
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 392
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
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Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100   105   110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115   120   125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130   135   140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145   150   155   160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165   170   175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180   185   190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195   200   205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210   215   220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225   230   235   240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245   250   255
Pro Lys Asp Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260   265   270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275   280   285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290   295   300
Asp Tyr Asp Met Thr Gln Ile Phe Asp Gly Thr Leu Val Glu Ala Asp
305   310   315   320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325   330   335
Gln Ser Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340   345   350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355   360   365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370   375   380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu

385 390 395 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
405 410 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
420 425 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
435 440 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
450 455 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465 470 475 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
485 490 495
Gln Thr Gly His His His His His His
500 505

<210> 393
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 393
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catgagaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccagtgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgga gcaaccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
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gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
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tttctgggta accgtcagga gactgtggta accgatgaaa acggcgaggc gacctttttc 1440
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catcaccatc accattag 1518

<210> 394
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 394
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
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20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Glu Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Glu Gln Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
325 330 335
Gln Ser Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
340 345 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro

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        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Thr Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 395
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 395
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaaaccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
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gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
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tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 396
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 396
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
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Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu

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                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 397
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 397

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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgtga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
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gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 398
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 398
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
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Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg

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    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 399
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 399
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcagc tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
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ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
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gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
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catcaccatc accattag 1518

<210> 400
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 400
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly

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            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Leu Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 401
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 401
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaccagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
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ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
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catcaccatc accattag 1518

<210> 402
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 402
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Asp Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile

225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
325 330 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
340 345 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
355 360 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
370 375 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385 390 395 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
405 410 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
420 425 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
435 440 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
450 455 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465 470 475 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
485 490 495
Gln Thr Gly His His His His His His
500 505

<210> 403
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 403
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ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tataccttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480

agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaaaccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gattgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 404
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 404
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg

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        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Ile Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 405
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 405
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240

gcgcaactgc tggcggcgat cgatgcgctg catgagaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gcaaccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 406
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 406
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Glu Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys

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                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Gln Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 407
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 407

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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat taccctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 408
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 408
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro

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    130                 135                 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile Thr
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 409
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 409
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaaacgac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
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gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 410
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 410
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
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Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys

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            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Thr Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 411

<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 411
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcgtctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
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gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 412
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 412
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys

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65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Arg Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
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500 505

<210> 413
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 413
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tatcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 414
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 414
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
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Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala

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        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Ile Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
```

```
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 415
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 415
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg gcattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcgtctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
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tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg ctggaggaag ttatcggcca aactggccac 1500
catcaccatc accattag                                              1518
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<210> 416
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 416
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Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
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1               5                   10                  15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20                  25                  30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Gly Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Arg Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
```

```
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Leu Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 417
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 417
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atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg accgtaccca atgggatgat gaaattattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
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gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
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tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag                                              1518
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<210> 418
<211> 505
<212> PRT
<213> Artificial Sequence

<220>

<223> Variant of alpha-amylase from Escherichia coli

<400> 418
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Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20                  25                  30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Arg Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
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```
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
```

<210> 419
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 419
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg gcattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
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aagcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
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gacggcgaaa cctacccgat cgacatgccg atcattgagg aactggacga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgaaggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag                                              1518
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<210> 420
<211> 505

<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 420
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Gly Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100   105   110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115   120   125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130   135   140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145   150   155   160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165   170   175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180   185   190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195   200   205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210   215   220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225   230   235   240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245   250   255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260   265   270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275   280   285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Lys Gln Gly Arg
    290   295   300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305   310   315   320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325   330   335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Arg Leu Ala Tyr
            340   345   350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355   360   365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr

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    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Glu Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Glu Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 421
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 421

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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag                                              1518
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<210> 422
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 422
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
325 330 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr

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            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 423
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 423

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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgaca accgtaccca atgggatgat gaaattattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgat cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcgtctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg aactggacga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
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gacgaaggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg ctggaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 424
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 424
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Thr Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asn Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Asp His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp

305 310 315 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
325 330 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Arg Leu Ala Tyr
340 345 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
355 360 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
370 375 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Glu Leu Asp Glu Leu Ile Leu
385 390 395 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
405 410 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
420 425 430
Cys Val Val Val Met Ser Asn Gly Asp Glu Gly Glu Lys Thr Ile His
435 440 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
450 455 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465 470 475 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Leu Glu Glu Val Ile Gly
485 490 495
Gln Thr Gly His His His His His His
500 505

<210> 425
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 425
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgat cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcgtctg gcgtatgcgc tgattctgct gcgtgagaat 1080

ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgaaggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 426
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 426
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Asp His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe

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        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Arg Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Glu Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 427
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 427
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
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gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 428
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 428
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Thr Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser

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                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 429
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 429
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattac catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tataccttтc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
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atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gtcgccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgaaggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg ctggaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 430
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 430
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Thr Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met

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    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Ser Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Glu Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Leu Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 431
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 431
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360

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aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcgtctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgaaggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag                                              1518
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<210> 432
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 432

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Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1               5                  10                  15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20                  25                  30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
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            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Arg Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Glu Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 433
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 433
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120

ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg gcattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg accgtaccga atgggatgat gaagttattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgat cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcgtctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 434
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 434
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Gly Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Glu Trp
115 120 125
Asp Asp Glu Val Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe

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145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Asp His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Arg Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 435
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 435
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaaaccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca atcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 436
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 436
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp

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        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ser Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 437
<211> 1518
<212> DNA

<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 437
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccagagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catagtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcgtctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg ctggaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 438
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 438
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Ile Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala

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                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Arg Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Leu Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 439
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 439
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattac catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgat cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
aagcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcgtctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg aactggacga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 440
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 440
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Thr Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu

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    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Asp His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Lys Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Arg Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Glu Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
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               485                 490                 495
Gln Thr Gly His His His His His His
            500                 505


<210> 441
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 441
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca atcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
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gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tactctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag                                              1518


<210> 442
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 442
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1               5                   10                  15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
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            20                  25                  30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ser Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile Thr
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
```

```
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 443
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 443
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atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaata agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt ttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gagtccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
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catcaccatc accattag                                              1518
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<210> 444
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 444
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100   105   110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115   120   125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130   135   140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145   150   155   160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165   170   175
Ile Val Asn Asp Tyr Thr Asn Lys Gly Trp Asn Asp Gln Val Asp Asp
            180   185   190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195   200   205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210   215   220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225   230   235   240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245   250   255
Pro Ser Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260   265   270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275   280   285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290   295   300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305   310   315   320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325   330   335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340   345   350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355   360   365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370   375   380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385   390   395   400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405   410   415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly

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            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 445
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 445
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
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catcaccatc accattag                                              1518
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<210> 446
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 446
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
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Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100   105   110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115   120   125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130   135   140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145   150   155   160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165   170   175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180   185   190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195   200   205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210   215   220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225   230   235   240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245   250   255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260   265   270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275   280   285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290   295   300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305   310   315   320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325   330   335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340   345   350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355   360   365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370   375   380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu

385 390 395 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
405 410 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
420 425 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
435 440 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
450 455 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465 470 475 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
485 490 495
Gln Thr Gly His His His His His His
500 505

<210> 447
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 447
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt ttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 448
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 448
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325 330 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340 345 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro

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        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 449
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 449
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt ttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca atcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
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tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 450
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 450
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu

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                325                 330                 335
Gln Ser Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 451
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 451

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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
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gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 452
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 452
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg

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    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 453
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 453
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atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
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ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 454
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 454
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly

```
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 455
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 455
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atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
```

ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 456
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 456
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile

225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
325 330 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
340 345 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
355 360 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
370 375 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385 390 395 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
405 410 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
420 425 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
435 440 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
450 455 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465 470 475 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
485 490 495
Gln Thr Gly His His His His His His
500 505

<210> 457
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 457
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tataccttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480

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agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacacgga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag                                              1518
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<210> 458
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 458

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Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1               5                  10                  15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20                  25                  30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
```

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        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Thr Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
```

<210> 459
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 459
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240

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gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gagtccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggtcg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag                                              1518
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<210> 460
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 460

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Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1               5                  10                  15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20                  25                  30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
```

```
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Ser Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
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<210> 461
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 461

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catcaccatc accattag 1518

<210> 462
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 462
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Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
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Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
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Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro

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Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
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Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 463
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

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ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
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tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
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tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
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ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
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catcaccatc accattag 1518

<210> 464
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 464
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
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Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys

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            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile Thr
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 465

<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
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aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
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atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
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catcaccatc accattag 1518

<210> 466
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 466
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
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Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Ile Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys

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65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
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500 505

<210> 467
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 467
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catcaccatc accattag 1518

<210> 468
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 468
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
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Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Ile Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala

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        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile Thr
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
```

```
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 469
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 469

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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa cattgtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
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gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag                                              1518
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<210> 470
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 470

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Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
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1               5                   10                  15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20                  25                  30
Glu Ile Gly Ile Asn Ile Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
```

```
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 471
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 471
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag                                              1518
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<210> 472
<211> 505
<212> PRT
<213> Artificial Sequence

<220>

<223> Variant of alpha-amylase from Escherichia coli

<400> 472

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Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1               5                  10                  15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20                  25                  30
Glu Ile Gly Ile Asn Ile Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
```

```
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 473
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 473
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gagtccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
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gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
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gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag                                              1518
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<210> 474
<211> 505

<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 474
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Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20                  25                  30
Glu Ile Gly Ile Asn Ile Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Ser Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
```

```
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 475
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 475

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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
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cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
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gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
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catcaccatc accattag                                              1518
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<210> 476
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 476
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1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Ile Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
325 330 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr

```
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 477
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 477

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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
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atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
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gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
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gacgatggcg agaaaaccat tactctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
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catcaccatc accattag 1518

<210> 478
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 478
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20 25 30
Glu Ile Gly Ile Asn Ile Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp

305 310 315 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
325 330 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
340 345 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
355 360 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
370 375 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385 390 395 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
405 410 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
420 425 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile Thr
435 440 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
450 455 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465 470 475 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
485 490 495
Gln Thr Gly His His His His His His
500 505

<210> 479
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 479
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaat 1080

ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tactctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 480
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 480
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Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Ile Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe

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        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile Thr
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 481
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 481
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaaacgac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840

gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
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ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
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gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
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catcaccatc accattag 1518

<210> 482
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 482
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1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Ile Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Thr Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser

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                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ser Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Arg Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 483
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600

atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaaacgac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
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gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tactctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
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catcaccatc accattag 1518

<210> 484
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 484
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
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Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Ile Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met

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    210                 215                 220
Glu Thr Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile Thr
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 485
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 485
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa cattgtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360

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aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaaacgac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gagtccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
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cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag                                              1518
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<210> 486
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 486

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Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20                  25                  30
Glu Ile Gly Ile Asn Ile Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
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            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Thr Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Ser Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 487
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 487
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa cattgtgtgg 120

ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaaacgac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gagtccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca atcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tactctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 488
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 488
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Ile Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe

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145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Thr Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Ser Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ser Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile Thr
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 489
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 489
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaaacgac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gagtccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcgtctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
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gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 490
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 490
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
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Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Ile Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100   105   110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp

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        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Thr Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Ser Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Arg Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 491
<211> 1518
<212> DNA

<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 491
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaaacgac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaat 1080
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gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
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catcaccatc accattag 1518

<210> 492
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 492
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20 25 30
Glu Ile Gly Ile Asn Ile Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala

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                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Thr Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 493
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 493
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa cattgtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaaacgac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca atcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
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catcaccatc accattag 1518

<210> 494
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 494
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Ile Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu

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    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Thr Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ser Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
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               485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 495
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 495
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tatcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tactctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag                                              1518
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<210> 496
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 496
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Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1               5                   10                  15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
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```
            20                  25                  30
Glu Ile Gly Ile Asn Ile Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Ile Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile Thr
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
```

```
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 497
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 497
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tatcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcgtctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tactctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag                                              1518
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<210> 498
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 498
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Ile Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100   105   110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115   120   125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130   135   140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145   150   155   160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165   170   175
Ile Ile Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180   185   190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195   200   205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210   215   220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225   230   235   240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245   250   255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260   265   270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275   280   285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290   295   300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305   310   315   320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325   330   335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Arg Leu Ala Tyr
            340   345   350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355   360   365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370   375   380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385   390   395   400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405   410   415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly

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            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile Thr
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 499
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 499
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tatcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaaacgac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
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cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
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gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
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tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
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catcaccatc accattag                                              1518
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<210> 500
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 500
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Ile Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100   105   110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115   120   125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130   135   140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145   150   155   160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165   170   175
Ile Ile Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180   185   190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195   200   205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210   215   220
Glu Thr Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225   230   235   240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245   250   255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260   265   270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275   280   285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290   295   300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305   310   315   320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325   330   335
Gln Ser Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340   345   350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355   360   365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370   375   380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu

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385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 501
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 501
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcgtctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
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gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
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gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag                                              1518
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<210> 502
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 502
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325 330 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Arg Leu Ala Tyr
            340 345 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro

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        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 503
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 503

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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaaacgac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
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tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 504
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 504
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Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Thr Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu

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                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 505
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 505
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaaacgac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
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gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 506
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 506
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Thr Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg

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    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 507
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 507

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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaaacgac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
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ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
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ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tactctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
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catcaccatc accattag 1518

<210> 508
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 508
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1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Thr Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly

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            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Arg Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile Thr
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 509
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 509

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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
ataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaaacgac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
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ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gagtccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tactctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 510
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 510
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Thr Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile

225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Ser Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
325 330 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
340 345 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
355 360 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
370 375 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385 390 395 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
405 410 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
420 425 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile Thr
435 440 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
450 455 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465 470 475 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
485 490 495
Gln Thr Gly His His His His His His
500 505

<210> 511
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 511
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tataccttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480

agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaaacgac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gagtccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcgtctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 512
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 512
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg

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        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Thr Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Ser Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Arg Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 513
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 513
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240

gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaaacgac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 514
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 514
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys

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                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Thr Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 515
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 515

atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaaacgac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
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gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tactctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 516
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 516
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro

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    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Thr Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile Thr
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 517
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 517
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaaacgac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcgtctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
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catcaccatc accattag 1518

<210> 518
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 518
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys

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            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Thr Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Arg Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 519

<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 519
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tatcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
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gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
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catcaccatc accattag 1518

<210> 520
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 520
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
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Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys

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65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Ile Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
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500 505

<210> 521
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 521
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tatcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
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ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
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gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
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tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 522
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 522
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
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Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala

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        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Ile Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
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465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 523
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 523
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
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tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
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gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
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tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag                                              1518
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<210> 524
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 524
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Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
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Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20                  25                  30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Ile Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
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        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 525
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 525
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gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
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tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
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catcaccatc accattag                                              1518
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<210> 526
<211> 505
<212> PRT
<213> Artificial Sequence

<220>

<223> Variant of alpha-amylase from Escherichia coli

<400> 526

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Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
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Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Ile Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
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                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile Thr
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
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Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
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Gln Thr Gly His His His His His His
            500                 505
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<210> 527
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 527
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
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aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
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tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
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catcaccatc accattag                                              1518
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<210> 528
<211> 505

<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

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Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100   105   110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115   120   125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130   135   140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145   150   155   160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165   170   175
Ile Ile Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180   185   190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195   200   205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210   215   220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225   230   235   240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245   250   255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260   265   270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275   280   285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290   295   300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305   310   315   320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325   330   335
Gln Ser Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340   345   350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355   360   365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr

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    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 529
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 529
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ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
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atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
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catcaccatc accattag                                              1518
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<210> 530
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 530
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20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Ile Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Ser Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
325 330 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr

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Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 531
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 531

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ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
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<210> 532
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 532
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20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Ile Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp

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305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 533
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<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 533
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<210> 534
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 534
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35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Ile Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe

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Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
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Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
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Gln Ser Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile Thr
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
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Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
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Gln Thr Gly His His His His His His
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<210> 535
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 535
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gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
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tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
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cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
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catcaccatc accattag 1518

<210> 536
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 536
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Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Ile Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser

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                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ser Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Arg Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
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<210> 537
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 537
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ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
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aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
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tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
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ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gtcgccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
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catcaccatc accattag 1518

<210> 538
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 538
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
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Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Ile Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met

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    210                 215                 220
Glu Thr Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Ser Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Arg Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ser Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 539
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 539
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
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<210> 540
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 540

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Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
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Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
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Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
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Ile Ile Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
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        195                 200                 205
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    210                 215                 220
Glu Thr Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
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Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ser Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
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<210> 541
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 541
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<210> 542
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 542
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Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Arg Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe

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145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 543
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 543
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaacccg gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
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cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
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catcaccatc accattag 1518

<210> 544
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 544
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
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Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100   105   110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp

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        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn Pro Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 545
<211> 1518
<212> DNA

<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 545
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ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
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gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
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tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
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catcaccatc accattag 1518

<210> 546
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 546
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala

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                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 547
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 547
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
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tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattcttcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
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catcaccatc accattag 1518

<210> 548
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 548
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1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu

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    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Leu Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
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               485                 490                 495
Gln Thr Gly His His His His His His
            500                 505


<210> 549
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 549
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
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aaccgccggg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
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tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
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gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
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gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
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catcaccatc accattag                                              1518


<210> 550
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 550
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1               5                   10                  15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
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            20                  25                  30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Arg Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
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    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 551
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 551
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccactg gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
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tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
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catcaccatc accattag                                              1518
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<210> 552
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 552
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Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100   105   110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115   120   125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130   135   140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145   150   155   160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165   170   175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180   185   190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195   200   205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210   215   220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225   230   235   240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245   250   255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260   265   270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275   280   285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290   295   300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305   310   315   320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325   330   335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340   345   350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355   360   365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370   375   380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385   390   395   400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405   410   415
Trp Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly

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            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 553
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 553
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt ttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccatggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag                                              1518
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<210> 554
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 554
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100   105   110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115   120   125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130   135   140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145   150   155   160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165   170   175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180   185   190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195   200   205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210   215   220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225   230   235   240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245   250   255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260   265   270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275   280   285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg His Gly Arg
    290   295   300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305   310   315   320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325   330   335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340   345   350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355   360   365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370   375   380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu

385 390 395 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
405 410 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
420 425 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
435 440 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
450 455 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465 470 475 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
485 490 495
Gln Thr Gly His His His His His His
500 505

<210> 555
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 555
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg gggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt ttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
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gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
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gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
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catcaccatc accattag 1518

<210> 556
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 556
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Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195 200 205
Asn His Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325 330 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340 345 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro

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        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 557
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 557

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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
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tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt ttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagtgtctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
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gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
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gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
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catcaccatc accattag 1518

<210> 558
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 558
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20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Cys Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu

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                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 559
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 559

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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtcggca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
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gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag                                              1518


<210> 560
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 560
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
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Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20                  25                  30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
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    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 561
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 561

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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat tatatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
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ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 562
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 562
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Tyr Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly

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            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 563
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 563
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
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ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgctggggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
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catcaccatc accattag 1518

<210> 564
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 564
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile

225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Trp Gly Arg
290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
325 330 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
340 345 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
355 360 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
370 375 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385 390 395 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
405 410 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
420 425 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
435 440 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
450 455 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465 470 475 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
485 490 495
Gln Thr Gly His His His His His His
500 505

<210> 565
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 565
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tataccttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480

agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
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gacggcgaaa cctacccgat cgacatgccg atcattcggg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 566
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 566
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg

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        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Arg Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 567
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 567
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240

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gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgag 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag                                              1518
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<210> 568
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 568

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1               5                  10                  15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20                  25                  30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
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                165                 170                 175
Ile Val Asn Glu Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 569
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 569

atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat cggatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 570
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 570
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Arg Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro

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    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 571
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 571
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgcaggggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 572
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 572
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys

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            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Arg Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 573

<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 573
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtacctg gtgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt ttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 574
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 574
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys

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65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Trp Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
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500 505

<210> 575
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 575
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttctga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tacacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaat tcggtaactt tgactacctg 600
atgggcgagg acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 576
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 576
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala

```
        35                  40                  45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Leu Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Phe Gly Asn Phe Asp Tyr Leu Met Gly Glu Asp Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
```

```
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 577
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 577
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact tttgtcaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag                                              1518
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<210> 578
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 578
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Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
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1               5                   10                  15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20                  25                  30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Cys His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
```

```
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 579
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 579
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttactggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag                                              1518
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<210> 580
<211> 505
<212> PRT
<213> Artificial Sequence

<220>

<223> Variant of alpha-amylase from Escherichia coli

<400> 580

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Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1               5                  10                  15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20                  25                  30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Thr Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
```

```
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 581
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 581

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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat catatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
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catcaccatc accattag                                              1518
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<210> 582
<211> 505

<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 582
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115 120 125
Asp Asp His Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325 330 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340 345 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355 360 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr

```
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 583
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 583
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac cgtttgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
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gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
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catcaccatc accattag                                              1518
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<210> 584
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 584
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
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Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Val Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
325 330 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr

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            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 585
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 585

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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cacggaattt ccgggctgcg ttgtggttat gagcaacggt 1320
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gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 586
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 586
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp

305 310 315 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
325 330 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
340 345 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
355 360 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
370 375 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385 390 395 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
405 410 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
420 425 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
435 440 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
450 455 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465 470 475 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
485 490 495
Gln Thr Gly His His His His His His
500 505

<210> 587
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 587
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttctga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaacta tgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagcttcgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcagc ataagtttca ccaggcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080

ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 588
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 588
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Leu Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Tyr Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser Phe Asp Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe

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        275                 280                 285
Asp Ala Pro Leu Gln His Lys Phe His Gln Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 589
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 589
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catgccaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattggggg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
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gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 590
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 590
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Glu Gly Leu Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Ala Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Gly Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser

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                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 591
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 591
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600

atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaatcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 592
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 592
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met

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    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ser Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 593
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 593
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360

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aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgttgtga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag                                              1518
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<210> 594
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 594

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Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20                  25                  30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
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            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Cys Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 595
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 595
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120

ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgattcgttt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 596
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 596
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe

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145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Ser Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 597
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 597
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg ggaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtattgta accgatgaaa acggcgaggc gacctttttc 1440
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catcaccatc accattag 1518

<210> 598
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 598
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1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Glu Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100   105   110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp

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        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Ile Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 599
<211> 1518
<212> DNA

<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 599
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcatttctg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 600
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 600
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala

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                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Ser Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 601
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 601
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg ggaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtattgta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 602
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 602
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu

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    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Ile Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
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               485                 490                 495
Gln Thr Gly His His His His His His
            500                 505


<210> 603
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 603
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattggggg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg ggaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtattgta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag                                              1518


<210> 604
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 604
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1               5                   10                  15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
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            20                  25                  30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Gly Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
```

```
    450                 455                 460
Arg Gln Glu Arg Ile Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 605
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 605
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga ctcgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttctga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tacacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt ttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaggcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
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catcaccatc accattag                                              1518
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<210> 606
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 606
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Leu Asn His Lys Met Gly Ala Asp Glu Lys
            100   105   110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115   120   125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130   135   140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145   150   155   160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165   170   175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180   185   190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195   200   205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210   215   220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225   230   235   240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245   250   255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260   265   270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275   280   285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290   295   300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305   310   315   320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325   330   335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340   345   350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355   360   365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370   375   380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385   390   395   400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405   410   415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly

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            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 607
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 607
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttctga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
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atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
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catcaccatc accattag                                              1518
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<210> 608
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 608
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Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Leu Asn His Lys Met Gly Ala Asp Glu Lys
            100   105   110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115   120   125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130   135   140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145   150   155   160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165   170   175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180   185   190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195   200   205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210   215   220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225   230   235   240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245   250   255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260   265   270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275   280   285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290   295   300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305   310   315   320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325   330   335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340   345   350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355   360   365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370   375   380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu

385 390 395 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
405 410 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
420 425 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
435 440 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
450 455 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
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Gln Thr Gly His His His His His His
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<210> 609
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

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ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
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tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccat gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
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catcaccatc accattag 1518

<210> 610
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 610
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Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Gln Ala Ser Arg Arg Gly Arg
290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
325 330 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
340 345 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro

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Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
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Tyr Pro Ile Asp Met Pro Ile Ile Arg Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
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Gln Thr Gly His His His His His His
            500                 505
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<210> 611
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 611

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ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
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catcaccatc accattag 1518

<210> 612
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 612
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35 40 45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn Pro Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Arg Gly Arg
290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu

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                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
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Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 613
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 613

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ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
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<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 614
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35 40 45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Trp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
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Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
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Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
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Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg

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305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
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<210> 615
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<212> DNA
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<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 615
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ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattcgtg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgacgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
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catcaccatc accattag 1518

<210> 616
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 616
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
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Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly

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            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Gln Ala Ser Arg His Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Arg Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 617
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 617

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ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
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ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccaggcgagc 900
cgccgtggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattcgtg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgacgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
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catcaccatc accattag                                              1518
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<210> 618
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 618

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Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20                  25                  30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Glu Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
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225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Gln Ala Ser Arg Arg Gly Arg
290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
325 330 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
340 345 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
355 360 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
370 375 380
Tyr Pro Ile Asp Met Pro Ile Ile Arg Gly Leu Asp Glu Leu Ile Leu
385 390 395 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
405 410 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
420 425 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
435 440 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
450 455 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465 470 475 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
485 490 495
Gln Thr Gly His His His His His His
500 505

<210> 619
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 619
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ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgccgtg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480

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agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccct gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccaggcgagc 900
cgctggggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattcgtg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag                                              1518


<210> 620
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 620
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1               5                  10                  15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20                  25                  30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Arg Asp Arg Arg Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
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        195                 200                 205
Asn Pro Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Gln Ala Ser Arg Trp Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Arg Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 621
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 621
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ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240

gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgccgtg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccct gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccagggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 622
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 622
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Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Arg Asp Arg Arg Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys

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                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn Pro Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 623
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 623

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ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgccgtg atcgtactca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgat 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgacgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 624
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 624
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35 40 45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
    50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Arg Asp Arg Thr Gln Trp
        115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro

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    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 625
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 625
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ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgccgtg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 626
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 626
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys

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            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Arg Asp Arg Arg Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 627

<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 627
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ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgccgtg atcgtcgcca atgggatgat gaaatcattg aatgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaaccaa 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccat gcggtgaccg gggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattcgtg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 628
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 628
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys

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65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Arg Asp Arg Arg Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Gln Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Arg Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
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500 505

<210> 629
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 629
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ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gagatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcagg aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattctgcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgatcaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg aaaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 630
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 630
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala

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        35                  40                  45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Leu Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
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465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 631
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 631

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ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccct gcggtgaccg gggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
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gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
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catcaccatc accattag                                              1518
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<210> 632
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 632

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Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
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1               5                   10                  15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20                  25                  30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Glu Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
```

```
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 633
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 633
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ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgat 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccat gcggtgaccg gggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccagggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattcgtg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgacgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
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catcaccatc accattag                                              1518
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<210> 634
<211> 505
<212> PRT
<213> Artificial Sequence

<220>

<223> Variant of alpha-amylase from Escherichia coli

<400> 634

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Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20                  25                  30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Arg Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
```

```
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 635
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 635
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ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgccgtg atcgtactca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccct gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccgtggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
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tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
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catcaccatc accattag                                              1518
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<210> 636
<211> 505

<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 636
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1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100   105   110
Glu His Ile Arg Val Gln Arg Val Asn Arg Arg Asp Arg Thr Gln Trp
        115   120   125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
    130   135   140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145   150   155   160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165   170   175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180   185   190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195   200   205
Asn Pro Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210   215   220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225   230   235   240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245   250   255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260   265   270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275   280   285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Arg Gly Arg
    290   295   300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305   310   315   320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325   330   335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340   345   350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355   360   365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr

```
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 637
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 637
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ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atggtgggat gagatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac cgtttgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcgcg aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
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gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgatcaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg aaaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
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catcaccatc accattag                                              1518
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<210> 638
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 638
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Trp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Val Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Arg Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
325 330 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr

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            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 639
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 639
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ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
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aaccgcgatg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
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atgggcgaga acatcgattt tcgtaaccct gcggtgaccc tggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
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gcgttcagcc gtagcggtac cgacgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
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gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 640
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 640
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Gln Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn Pro Ala Val Thr Leu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Gln Ala Ser Arg Arg Gly Arg
290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp

305 310 315 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
325 330 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
340 345 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
355 360 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
370 375 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385 390 395 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
405 410 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
420 425 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
435 440 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
450 455 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465 470 475 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
485 490 495
Gln Thr Gly His His His His His His
500 505

<210> 641
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 641
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
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ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gagatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac cgtttgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt ttaccgcga gtggattgaa cacgtgcagg aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttaccggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080

ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgatcaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcc gtaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggtc accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 642
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 642
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1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Val Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Thr Gly Lys Thr Thr Leu Phe

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        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Arg Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 643
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 643

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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gagatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattctgcaa 840
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gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgatcaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg aaaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtgagc accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 644
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 644
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser

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                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Leu Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Ser Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 645
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 645
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtactca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaaccaa 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600

atgggcgaga acatcgattt tcgtaaccat gcggtgaccc tggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgacgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
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catcaccatc accattag 1518

<210> 646
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 646
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Gln Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Leu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met

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    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 647
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 647
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360

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aaccgcgatg atcgtactca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccct gcggtgaccc tggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccgtggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattcgtg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
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catcaccatc accattag                                              1518
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<210> 648
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 648

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Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
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Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20                  25                  30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
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            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn Pro Ala Val Thr Leu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Arg Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Arg Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 649
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 649
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120

ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat tatatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttaccggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgatcaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg aaaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggtc accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 650
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 650
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Tyr Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe

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145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Thr Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 651
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 651
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgaggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gagatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgatcaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
cgcgatggcg aaaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 652
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 652
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100   105   110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp

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        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Arg Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 653
<211> 1518
<212> DNA

<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 653
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcgcg aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgttcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgatcaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg aaaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtgagc accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 654
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 654
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala

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                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Arg Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Val Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Ser Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 655
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 655
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gagatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcgcg aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattctgcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg aaaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcggggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 656
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 656
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu

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    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Arg Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Leu Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Gly Glu Val Ile Gly
```

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               485                 490                 495
Gln Thr Gly His His His His His His
            500                 505


<210> 657
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 657
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgccgtg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccat gcggtgaccc tggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccaggcgagc 900
cgctggggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattcgtg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgacgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag                                              1518


<210> 658
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 658
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1               5                   10                  15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
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            20                  25                  30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Arg Asp Arg Arg Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Glu Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Leu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Gln Ala Ser Arg Trp Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Arg Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
```

```
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 659
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 659
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat cacatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac cgtttgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt ttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgttcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggtc accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag                                              1518
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<210> 660
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 660
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100   105   110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115   120   125
Asp Asp His Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
    130   135   140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145   150   155   160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165   170   175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180   185   190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195   200   205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210   215   220
Glu Gln Thr Val Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225   230   235   240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245   250   255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260   265   270
Lys Leu Gln Thr Tyr Ile Val Gln Val Glu Gly Lys Thr Thr Leu Phe
        275   280   285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290   295   300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305   310   315   320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325   330   335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340   345   350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355   360   365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370   375   380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385   390   395   400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405   410   415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly

```
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 661
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 661
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atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atgtgattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccct gcggtgaccg gggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag                                              1518
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<210> 662
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 662
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100   105   110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
        115   120   125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
    130   135   140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145   150   155   160
Ser Gly Ile Asp Val Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165   170   175
Ile Val Asn Glu Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180   185   190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195   200   205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210   215   220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225   230   235   240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245   250   255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260   265   270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275   280   285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290   295   300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305   310   315   320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325   330   335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340   345   350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355   360   365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370   375   380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu

385 390 395 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
405 410 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
420 425 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
435 440 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
450 455 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465 470 475 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
485 490 495
Gln Thr Gly His His His His His His
500 505

<210> 663
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 663
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
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ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg atggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccct gcggtgaccg gggaaatcaa atattgggcg 660
cgttggctga tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgacttcga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggtcct gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 664
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 664
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100   105   110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
        115   120   125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
    130   135   140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145   150   155   160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165   170   175
Ile Val Asn Glu Tyr Thr Asn Asp Gly Trp Asn Asp Gln Val Asp Asp
            180   185   190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195   200   205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Leu Met
    210   215   220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225   230   235   240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245   250   255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260   265   270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275   280   285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290   295   300
Asp Phe Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305   310   315   320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325   330   335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340   345   350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro

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        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Leu Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 665
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 665
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atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacttacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacctgga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggctcga acatcgattt tcgtaaccct gcggtgaccg gggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt caagcacatc 720
ccggcgtggt ttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
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tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 666
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 666
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Leu Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Glu Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Ser Asn Ile Asp Phe Arg
195 200 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu

```
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 667
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 667

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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggccggagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccct gcggtgaccg gggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
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gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 668
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 668
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ala Gly Gly Arg Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Glu Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg

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    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 669
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 669

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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg atggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccct gcggtgaccg gggaactgaa atattgggcg 660
cgttgggtga tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgacttcga tctgacccaa atcttcaccg gcaccctggt ggaagcggac 960
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ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggtcat gagcaacggt 1320
gacgacggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 670
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 670
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Glu Tyr Thr Asn Asp Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn Pro Ala Val Thr Gly Glu Leu Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly

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            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Phe Asp Leu Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 671
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 671
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccct gcggtgaccg gggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
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ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggagga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 672
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 672
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Glu Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile

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225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Glu Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 673
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 673
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac gtatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
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agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccct gcggtgaccg gggaaatcaa atattgggcg 660
cgttggctga tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgacttcga tctgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 674
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 674
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu Arg Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Glu Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg

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        195                 200                 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Leu Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Phe Asp Leu Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 675
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 675
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
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ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240

gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccct gcggtgaccg gggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctgcagga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 676
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 676
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys

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                165                 170                 175
Ile Val Asn Glu Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Gln Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 677
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 677

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ctgccgccgg cgtacaaagg tgatgcgggt ggctacagcg ttggctacga cacttacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacctgga gaacccgagc gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggctcga acatcgattt tcgtaaccct gcggtgaccg gggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt caagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 678
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 678
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Asp
        35 40 45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
    50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
        115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro

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    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Leu Glu Asn Pro Ser Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Glu Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Ser Asn Ile Asp Phe Arg
        195                 200                 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 679
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 679
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
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ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccct gcggtgaccg gggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tccgctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 680
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 680
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys

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            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Glu Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile Pro
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 681

<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 681
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgagtaaagg tgctgcgggt ggctacagcg ttggctacga cacttacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacctgga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaaa acatcgattt tcgtaaccct gcggtgaccg gggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt caagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgacgcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 682
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 682
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Ser Lys Gly Ala
        35   40   45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys

```
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Leu Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Glu Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Asp Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
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500 505

<210> 683
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 683
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccct gcggtgaccg gggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcagg cgaagtttca ccatgcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 684
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 684
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala

```
        35                  40                  45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Glu Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Ala Lys Phe His His Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
```

```
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 685
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 685

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atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccct gcggtgaccg gggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag agatgtcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag                                              1518
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<210> 686
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 686

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Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
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1               5                   10                  15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20                  25                  30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Glu Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Met Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
```

```
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 687
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 687
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atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtacaaagg tgctgcgggt ggctacagcg ttggctacga cgcttacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacctgga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaaa acatcgattt tcgtaaccct gcggtgaccg gggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt caagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag                                              1518
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<210> 688
<211> 505
<212> PRT
<213> Artificial Sequence

<220>

<223> Variant of alpha-amylase from Escherichia coli

<400> 688

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Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1               5                  10                  15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20                  25                  30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Ala Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Leu Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Glu Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
```

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                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 689
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 689
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtacaaagg tgatgcgggt ggctacagcg ttggctacga cacttacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacatcga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaaa acatcgattt tcgtaaccct gcggtgaccg gggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt caagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag                                              1518
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<210> 690
<211> 505

<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 690
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Asp
        35   40   45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100   105   110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
        115   120   125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
    130   135   140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145   150   155   160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165   170   175
Ile Val Asn Glu Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180   185   190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195   200   205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210   215   220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225   230   235   240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245   250   255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260   265   270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275   280   285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290   295   300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305   310   315   320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325   330   335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340   345   350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355   360   365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr

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    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 691
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 691
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg agggctggaa cgatgatgtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccct gcggtgaccg gggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag                                              1518
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<210> 692
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 692
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Glu Tyr Thr Asn Glu Gly Trp Asn Asp Asp Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
325 330 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr

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            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 693
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 693

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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac gtatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccct gcggtgaccg gggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
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gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 694
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 694
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu Arg Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Glu Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp

305 310 315 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
325 330 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
340 345 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
355 360 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
370 375 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385 390 395 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
405 410 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
420 425 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
435 440 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
450 455 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465 470 475 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
485 490 495
Gln Thr Gly His His His His His His
500 505

<210> 695
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 695
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ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcggcgctgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccct gcggtgaccg gggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080

ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 696
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 696
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Ala Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Glu Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe

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        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 697
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 697

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atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgctgcgggt ggctacagcg ttggctacga cgcttacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacatcga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggctcga acatcgattt tcgtaaccct gcggtgaccg gggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt caagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
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gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 698
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 698
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1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Ala Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Glu Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Ser Asn Ile Asp Phe Arg
195 200 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser

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                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 699
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 699
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ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600

atgggcgaga acatcgattt tcgtaaccct gcggtgaccg gggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcctgggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 700
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 700
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Glu Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Val Met

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    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Leu Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 701
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 701
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ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcacgatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360

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aaccgcgatg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccct gcggtgaccg gggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag                                              1518
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<210> 702
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 702

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Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1               5                  10                  15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20                  25                  30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Thr Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Glu Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
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            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 703
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 703
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120

ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccct gcggtgaccg gggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacgcgg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 704
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 704
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe

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145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Glu Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Ala Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 705
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 705
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccct gcggtgaccg gggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
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gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 706
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 706
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100   105   110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp

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        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Glu Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Met Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 707
<211> 1518
<212> DNA

<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 707
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
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ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccct gcggtgaccg gggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttgggggcca aactggccac 1500
catcaccatc accattag 1518

<210> 708
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 708
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala

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                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Glu Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Gly Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 709
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 709
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ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccct gcggtgaccg gggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gagtccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 710
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 710
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu

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    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Glu Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Ser Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
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               485                 490                 495
Gln Thr Gly His His His His His His
            500                 505


<210> 711
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 711
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgctgcgggt ggctacagcg ttggctacga cacttacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaaa acatcgattt tcgtaaccct gcggtgaccg gggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt caagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca caacgcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag                                              1518


<210> 712
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 712
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1               5                   10                  15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
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            20                  25                  30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Glu Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Asn Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
```

```
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 713
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 713
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atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
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ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccct gcggtgaccg gggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
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catcaccatc accattag                                              1518
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<210> 714
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 714
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Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100   105   110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
        115   120   125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
    130   135   140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145   150   155   160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165   170   175
Ile Val Asn Glu Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180   185   190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195   200   205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210   215   220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225   230   235   240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245   250   255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260   265   270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275   280   285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290   295   300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305   310   315   320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325   330   335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340   345   350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355   360   365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370   375   380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385   390   395   400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405   410   415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly

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            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Leu Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 715
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 715
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggctcga acatcgattt tcgtaaccct gcggtgaccg gggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag                                              1518
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<210> 716
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 716
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100   105   110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
        115   120   125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
    130   135   140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145   150   155   160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165   170   175
Ile Val Asn Glu Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180   185   190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Ser Asn Ile Asp Phe Arg
        195   200   205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210   215   220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225   230   235   240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245   250   255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260   265   270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275   280   285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290   295   300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305   310   315   320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325   330   335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340   345   350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355   360   365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370   375   380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu

385 390 395 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
405 410 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
420 425 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
435 440 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
450 455 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465 470 475 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
485 490 495
Gln Thr Gly His His His His His His
500 505

<210> 717
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 717
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ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccct gcggtgaccg gggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga ggttgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 718
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 718
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35 40 45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
    50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
        115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
    130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165 170 175
Ile Val Asn Glu Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195 200 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325 330 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340 345 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro

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        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Val Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 719
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 719

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ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccct gcggtgaccg gggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt ttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgattaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
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tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 720
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 720
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Glu Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
260 265 270
Lys Leu Ile Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu

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                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 721
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 721

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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattta taacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccct gcggtgaccg gggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
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gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 722
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 722
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Tyr Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Glu Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg

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    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 723
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 723

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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggcaagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccct gcggtgaccg gggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
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```
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag                                              1518


<210> 724
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 724
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1               5                  10                  15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20                  25                  30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Lys Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Glu Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
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```
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 725
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 725
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccct gcggtgaccg gggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
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ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag agaggtcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag                                              1518
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<210> 726
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 726

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Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1               5                  10                  15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20                  25                  30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Glu Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
```

225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Arg Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
325 330 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
340 345 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
355 360 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
370 375 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385 390 395 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
405 410 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
420 425 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
435 440 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
450 455 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465 470 475 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
485 490 495
Gln Thr Gly His His His His His His
500 505

<210> 727
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 727
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480

agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccct gcggtgaccg gggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta tgaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 728
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 728
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Glu Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg

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        195                 200                 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Met Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
```

<210> 729
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 729
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240

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gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccct gcggtgaccg gggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgatgcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
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gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
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catcaccatc accattag                                              1518
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<210> 730
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 730

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1               5                  10                  15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20                  25                  30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
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                165                 170                 175
Ile Val Asn Glu Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Asp Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 731
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 731

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ctgccgccgg cgtacaaagg tgctgcgggt ggctacagcg ttggctacga cacttacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacatcga gaacccgagc gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaaa acatcgattt tcgtaaccct gcggtgaccg gggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccacgcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 732
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 732
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Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro

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    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Ser Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Glu Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 733
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 733
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ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccct gcggtgaccg gggaaattaa atattgggcg 660
cgttgggtta tgacgcaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 734
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 734
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1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys

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            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Glu Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Thr Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 735

<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

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ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccct gcggtgaccg gggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa gaggattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 736
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 736
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1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys

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65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Glu Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Glu Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
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500 505

<210> 737
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 737
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ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccct gcggtgaccg gggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgattgt 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 738
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 738
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala

```
        35                  40                  45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Glu Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Cys Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
```

```
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
```

<210> 739
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 739
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccct gcggtgaccg gggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcggaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag                                              1518
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<210> 740
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 740
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Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
```

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1               5                   10                  15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20                  25                  30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Glu Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Arg Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
```

```
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 741
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 741
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccct gcggtgaccg gggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag                                              1518
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<210> 742
<211> 505
<212> PRT
<213> Artificial Sequence

<220>

<223> Variant of alpha-amylase from Escherichia coli

<400> 742

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Met Leu Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1               5                  10                  15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20                  25                  30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Glu Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
```

```
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
```

<210> 743
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 743

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atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccct gcggtgaccg gggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggtc tgaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag                                              1518
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<210> 744
<211> 505

<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 744
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100   105   110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
        115   120   125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
    130   135   140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145   150   155   160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165   170   175
Ile Val Asn Glu Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180   185   190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195   200   205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210   215   220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225   230   235   240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245   250   255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260   265   270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Leu Thr Thr Leu Phe
        275   280   285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290   295   300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305   310   315   320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325   330   335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340   345   350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355   360   365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr

```
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
```

<210> 745
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 745

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atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccct gcggtgaccg gggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt acgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag                                              1518
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<210> 746
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 746
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Glu Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
325 330 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr

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            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Thr Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 747
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 747

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ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgaag atcgtcgcca atgggatgat gaaatcattg aatgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg atggctggaa cgatcaggtt gacgatgaac tgggtaacta tgactacctg 600
atgggcgaga acatcgattt tcgtaaccct gcggtgaccg gggaaatcaa atattgggcg 660
cgttggctga tggggcaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcaaaccta cattgatcaa 840
gttgagggta agaccacgct gttcgacgcg ccgctgcagg caaagtttca ccatgcgagc 900
cgccaaggtc gtgacttcga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctgcaaga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggtcct gagcaacggt 1320
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gacgatggcg agaaaaccat tcagctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtattgta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 748
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 748
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Glu Asp Arg Arg Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Glu Tyr Thr Asn Asp Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Tyr Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Leu Met
210 215 220
Gly Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
275 280 285
Asp Ala Pro Leu Gln Ala Lys Phe His His Ala Ser Arg Gln Gly Arg
290 295 300
Asp Phe Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp

305 310 315 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
325 330 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
340 345 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
355 360 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
370 375 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Gln Glu Leu Ile Leu
385 390 395 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
405 410 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
420 425 430
Cys Val Val Val Leu Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile Gln
435 440 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
450 455 460
Arg Gln Glu Arg Ile Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465 470 475 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
485 490 495
Gln Thr Gly His His His His His His
500 505

<210> 749
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 749
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ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg atggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccct gcggtgaccg gggaaatcaa atattgggcg 660
cgttggctga tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt ttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgacttcga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080

ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggtcct gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggcccc 1500
catcaccatc accattag 1518

<210> 750
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 750
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Glu Tyr Thr Asn Asp Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Leu Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe

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        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Phe Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Leu Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly Pro His His His His His
            500                 505
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<210> 751
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 751
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ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgaag atcgtcgcca atgggatgat gaaatcattg aatgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg atggctggaa cgatcaggtt gacgatgaac tgggtaacta tgactacctg 600
atgggcgaga acatcgattt tcgtaaccct gcggtgaccg gggaaatcaa atattgggcg 660
cgttggctga tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt ttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcaaaccta cattgatcaa 840
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gttgagggta agaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgacttcga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggtcct gagcaacggt 1320
gacgatggcg agaaaaccat tcatctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 752
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 752
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Glu Asp Arg Arg Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Glu Tyr Thr Asn Asp Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Tyr Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Leu Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser

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                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Phe Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Leu Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 753
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 753
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg atggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
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atgggcgaga acatcgattt tcgtaaccct gcggtgaccg gggaaatcaa atattgggcg 660
cgttggctga tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgacttcga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atctgtgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggtcct gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccttc accattag 1518

<210> 754
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 754
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Glu Tyr Thr Asn Asp Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Leu Met

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    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Phe Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Cys Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Leu Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His Leu His His
            500                 505
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<210> 755
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 755
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360

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aaccgcgatg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg atggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccct gcggtgaccg gggaaatcaa atattgggcg 660
cgttggctga tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgacttcga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggtcct gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctttcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag                                              1518
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<210> 756
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 756

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Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1               5                  10                  15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20                  25                  30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Glu Tyr Thr Asn Asp Gly Trp Asn Asp Gln Val Asp Asp
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            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Leu Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Phe Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Leu Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Phe Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 757
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 757
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120

ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
tatttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg atggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccct gcggtgaccg gggaaatcaa atattgggcg 660
cgttggctga tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgacttcga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggtcct gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 758
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 758
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Tyr Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe

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145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Glu Tyr Thr Asn Asp Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Leu Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Phe Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Leu Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 759
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 759
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
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ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg atggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccct gcggtgaccg gggaaatcaa atattgggcg 660
cgttggctga tggggcaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcaaaccta cattgatcaa 840
gttgagggta agaccacgct gttcgacgcg ccgctgcagg caaagtttca caatgcgagc 900
cgccaaggtc gtgacttcga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctgcaaga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggtcct gagcaacggt 1320
gacgatggcg agaaaaccat tcatctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgttgta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggtg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 760
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 760
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100   105   110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp

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        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Glu Tyr Thr Asn Asp Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Leu Met
    210                 215                 220
Gly Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Ala Lys Phe His Asn Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Phe Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Gln Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Leu Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 761
<211> 1518
<212> DNA

<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 761
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
tttccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg atggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccct gcggtgaccg gggaaatcaa atattgggcg 660
cgttggctga tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgacttcga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggtcct gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 762
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 762
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Phe Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala

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                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Glu Tyr Thr Asn Asp Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Leu Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Phe Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Leu Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 763
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 763
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgaag atcgtcgcca atgggatgat gaaatcattg aatgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccgagc gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg atggctggaa cgatcaggtt gacgatgaac tgggtaacta tgactacctg 600
atgggcgaga acatcgattt tcgtaaccct gcggtgaccg gggaaatcaa atattgggcg 660
cgttggctga tggagcaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgatcaccta cattgatcaa 840
gttgagggta agaccacgct gttcgacgcg ccgctgcaga tgaagtttca caatgcgagc 900
cgccagggtc gtgacttcga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctgcaaga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggtcct gagcaacggt 1320
gacgatggcg agaaaaccat tcagctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaaccagg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 764
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 764
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu

```
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Glu Asp Arg Arg Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Ser Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Glu Tyr Thr Asn Asp Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Tyr Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Leu Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Ile Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Asn Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Phe Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Gln Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Leu Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile Gln
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gln Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
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               485                 490                 495
Gln Thr Gly His His His His His His
            500                 505


<210> 765
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 765
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg atggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccct gcggtgaccg gggaaatcaa atattgggcg 660
cgttggctga tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgacttcga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggtcct gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctatcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag                                              1518


<210> 766
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 766
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1               5                   10                  15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
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            20                  25                  30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Glu Tyr Thr Asn Asp Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Leu Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Phe Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Leu Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Tyr Arg Asp Phe Leu Gly Asn
```

```
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 767
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 767
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg atggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccct gcggtgaccg gggaaatcaa atattgggcg 660
cgttggctga tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt ttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgacttcga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggtcct gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactcggcac 1500
catcaccatc accattag                                              1518
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<210> 768
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 768
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100   105   110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
        115   120   125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
    130   135   140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145   150   155   160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165   170   175
Ile Val Asn Glu Tyr Thr Asn Asp Gly Trp Asn Asp Gln Val Asp Asp
            180   185   190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195   200   205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Leu Met
    210   215   220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225   230   235   240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245   250   255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260   265   270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275   280   285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290   295   300
Asp Phe Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305   310   315   320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325   330   335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340   345   350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355   360   365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370   375   380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385   390   395   400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405   410   415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly

```
            420                 425                 430
Cys Val Val Val Leu Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Arg His His His His His His
            500                 505
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<210> 769
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 769
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ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattg aatgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccgagc gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg atggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccct gcggtgaccg gggaaatcaa atattgggcg 660
cgttggctga tggagcaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt ttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgatcaccta cattgatcaa 840
gttgagggta agaccacgct gttcgacgcg ccgctgcagg caaagtttca caatgcgagc 900
cgccaaggtc gtgacttcga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggtcct gagcaacggt 1320
gacgatggcg agaaaaccat tcagctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag                                              1518
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<210> 770
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 770
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100   105   110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
        115   120   125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
    130   135   140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145   150   155   160
Ser Gly Ile Asp His Ile Glu Asn Pro Ser Glu Asp Gly Ile Phe Lys
                165   170   175
Ile Val Asn Glu Tyr Thr Asn Asp Gly Trp Asn Asp Gln Val Asp Asp
            180   185   190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195   200   205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Leu Met
    210   215   220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225   230   235   240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245   250   255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260   265   270
Lys Leu Ile Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275   280   285
Asp Ala Pro Leu Gln Ala Lys Phe His Asn Ala Ser Arg Gln Gly Arg
    290   295   300
Asp Phe Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305   310   315   320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325   330   335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340   345   350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355   360   365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370   375   380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu

385 390 395 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
405 410 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
420 425 430
Cys Val Val Val Leu Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile Gln
435 440 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
450 455 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465 470 475 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
485 490 495
Gln Thr Gly His His His His His His
500 505

<210> 771
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 771
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ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgaag atcgtcgcca atgggatgat gaaatcattg aatgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg atggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccct gcggtgaccg gggaaatcaa atattgggcg 660
cgttggctga tggagcaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcaaaccta cattgatcaa 840
gttgagggtc tgaccacgct gttcgacgcg ccgctgcagg caaagtttca ccatgcgagc 900
cgccaaggtc gtgacttcga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccaca cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctgcaaga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggtcct gagcaacggt 1320
gacgatggcg agaaaaccat tcagctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
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catcaccatc accattag 1518

<210> 772
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 772
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1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100   105   110
Glu His Ile Arg Val Gln Arg Val Asn Arg Glu Asp Arg Arg Gln Trp
        115   120   125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
    130   135   140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145   150   155   160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165   170   175
Ile Val Asn Glu Tyr Thr Asn Asp Gly Trp Asn Asp Gln Val Asp Asp
            180   185   190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195   200   205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Leu Met
    210   215   220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225   230   235   240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245   250   255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260   265   270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Leu Thr Thr Leu Phe
        275   280   285
Asp Ala Pro Leu Gln Ala Lys Phe His His Ala Ser Arg Gln Gly Arg
    290   295   300
Asp Phe Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305   310   315   320
Pro Ala His Thr Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325   330   335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340   345   350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro

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        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Gln Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Leu Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile Gln
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 773
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 773

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ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattg aatgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atgtcattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg atggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccct gcggtgaccg gggaaatcaa atattgggcg 660
cgttggctga tggggcaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt ttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcaaaccta cattgatcaa 840
gttgagggtc tgaccacgct gttcgacgcg ccgctgcaga tgaagtttca caatgcgagc 900
cgccaaggtc gtgacttcga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggtcct gagcaacggt 1320
gacgatggcg agaaaaccat tcatctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtattgta accgatgaaa acggcgaggc gacctttttc 1440
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tgcaaccagg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 774
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 774
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1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp Val Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Glu Tyr Thr Asn Asp Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Leu Met
210 215 220
Gly Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Leu Thr Thr Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Asn Ala Ser Arg Gln Gly Arg
290 295 300
Asp Phe Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu

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                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Leu Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Ile Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gln Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 775
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 775

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ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acgtcgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg atggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acgtcgactt tcgtaaccct gcggtgaccg gggaaatcaa atattgggcg 660
cgttggctga tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgacttcga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
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gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagtc gtagcggtac cactgaattt ccgggctgcg ttgtggtcct gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 776
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 776
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Val Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Glu Tyr Thr Asn Asp Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Val Asp Phe Arg
195 200 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Leu Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg

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    290                 295                 300
Asp Phe Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Leu Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 777
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 777
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ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg atggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccct gcggtgaccg gggaaatcaa atattgggcg 660
cgttggctga tggaacaatg tcaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt ttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgacttcga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
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ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
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gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
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catcaccatc accattag 1518

<210> 778
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 778
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Glu Tyr Thr Asn Asp Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Leu Met
210 215 220
Glu Gln Cys Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly

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            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Phe Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Leu Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 779
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 779
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg atggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acgtcgagtt tcgtaaccct gcggtgaccg gggaaatcaa atattgggcg 660
cgttggctga tggaacaaac gcaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
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ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgacttcga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggtcct gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 780
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 780
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Glu Tyr Thr Asn Asp Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Val Glu Phe Arg
195 200 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Leu Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile

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225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Phe Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Leu Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 781
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 781
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga ctcgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
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agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg atggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccct gcggtgaccg gggaaatcaa atattgggcg 660
cgttggctga tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgacttcga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggtcct gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggcccc 1500
cctcaccatc accattag                                              1518


<210> 782
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 782
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1               5                  10                  15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20                  25                  30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Glu Tyr Thr Asn Asp Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
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        195                 200                 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Leu Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Phe Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Leu Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly Pro Pro His His His His
            500                 505
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<210> 783
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 783
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240

gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg atggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acgtcgagtt tcgtaaccct gcggtgaccg gggaaatcaa atattgggcg 660
cgttggctgc tggaacaaac gcaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgacttcga tatgacccaa atcttcaccg gcagcctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggtcct gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac cttccgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttta 1440
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catcaccatc accattag 1518

<210> 784
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 784
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys

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                165                 170                 175
Ile Val Asn Glu Tyr Thr Asn Asp Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Val Glu Phe Arg
        195                 200                 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Leu Leu
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Phe Asp Met Thr Gln Ile Phe Thr Gly Ser Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Leu Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Phe Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Leu
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 785
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 785

atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
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ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acctggcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg atggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccct gcggtgaccg gggaaatcaa atattgggcg 660
cgttggctga tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacattcaag aggtttcgcc gaagccgctg 780
tttatcgttg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aagtcacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgacttcga tatgacccaa atcttcaccg gcaccctggt tgaagcggac 960
ccggcccaca ccgtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggtcct gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 786
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 786
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Leu Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro

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    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Glu Tyr Thr Asn Asp Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Leu Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Ile Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Val Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Phe Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Thr Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Leu Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 787
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 787
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acgtcgcggt gattctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg atggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgactt tcgtaaccct gcggtgaccg gggaaatcaa atattgggcg 660
cgttggctga tggaacaagt acaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt ttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgacttcga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcgtcc gtagcggtac cactgaattt ccgggctgcg ttgtggtcct gagtaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 788
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 788
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Val Ala
                85   90   95
Val Ile Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys

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            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Glu Tyr Thr Asn Asp Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Leu Met
    210                 215                 220
Glu Gln Val Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Phe Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Val Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Leu Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 789

<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 789
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acgtcgcggt gattctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg atggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acgtcgactt tcgtaaccct gcggtgaccg gggaaatcaa atattgggcg 660
cgttggctga tggaacaagt acaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgacttcga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcgtcc gtagcggtac cactgaattt ccgggctgcg ttgtggtcct gagtaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac cttccgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 790
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 790
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys

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65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Val Ala
                85                  90                  95
Val Ile Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Glu Tyr Thr Asn Asp Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Val Asp Phe Arg
        195                 200                 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Leu Met
    210                 215                 220
Glu Gln Val Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Phe Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Val Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Leu Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Phe Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
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500 505

<210> 791
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 791
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
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ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg atggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgagtt tcgtaaccct gcggtgaccg gggaaatcaa atattgggcg 660
cgttggctga tggaacaagt acaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt ttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgacttcga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggtcct gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
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catcaccatc accattag 1518

<210> 792
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 792
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala

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        35                  40                  45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Glu Tyr Thr Asn Asp Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Glu Phe Arg
        195                 200                 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Leu Met
    210                 215                 220
Glu Gln Val Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Phe Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Leu Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
```

```
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 793
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 793

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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catgatctgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgaca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg atggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccct gcggtgaccg gggaaatcaa atattgggcg 660
cgttggctga tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgttg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaactacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgacttcga tatgacccaa atcttcaccg gcaccctggt tgaagcggac 960
ccggcccaca ccgtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg attattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcgtc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggtcct gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
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catcaccatc accattag                                              1518
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<210> 794
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 794

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Met Arg Asn Pro Thr Ile Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
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Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20                  25                  30
Glu Ile Gly Ile Asn Met Ile Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Asp Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Glu Tyr Thr Asn Asp Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Leu Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Phe Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Thr Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Val Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Leu Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
```

```
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 795
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 795
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg atggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgagtt tcgtaaccct gcggtgaccg gggaaatcaa atattgggcg 660
cgttggctga tggaacaagt acaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgacttcga tatgacccaa atcttcaccg gcagcctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcgtcc gtagcggtac cactgaattt ccgggctgcg ttgtggtcct gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag                                              1518
```

<210> 796
<211> 505
<212> PRT
<213> Artificial Sequence

<220>

<223> Variant of alpha-amylase from Escherichia coli

<400> 796

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Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1               5                  10                  15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20                  25                  30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Glu Tyr Thr Asn Asp Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Glu Phe Arg
        195                 200                 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Leu Met
    210                 215                 220
Glu Gln Val Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Phe Asp Met Thr Gln Ile Phe Thr Gly Ser Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
```

```
                405                 410                 415
Pro Asn Cys Ile Ala Phe Val Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Leu Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 797
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 797
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ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattc gttgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg atggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccct gcggtgaccg gggaaatcaa atattgggcg 660
cgttggctga tggggcaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgatcaccta cattgatcaa 840
gttgagggta agaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgctggggtc gtgacttcga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggtcct gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag                                              1518
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<210> 798
<211> 505

<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 798
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Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1               5                  10                  15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20                  25                  30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Arg Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Glu Tyr Thr Asn Asp Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Leu Met
    210                 215                 220
Gly Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Ile Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Trp Gly Arg
    290                 295                 300
Asp Phe Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
```

```
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Leu Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 799
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 799

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ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtaatca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg atggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acgtcgagtt tcgtaaccct gcggtgaccg gggaaatcaa atattgggcg 660
cgttggctga tggaacaaac gcaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgacttcga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
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gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggtcct gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag                                              1518
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<210> 800
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 800
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Asn Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Glu Tyr Thr Asn Asp Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Val Glu Phe Arg
195 200 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Leu Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
290 295 300
Asp Phe Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
325 330 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr

```
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Leu Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 801
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 801

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ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtctgca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg atggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acgtcgagtt tcgtaaccct gcggtgaccg gggaaatcaa atattgggcg 660
cgttggctga tggaacaaac gcaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgacttcga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggtcct gagcaacggt 1320
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gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
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catcaccatc accattag 1518

<210> 802
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 802
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Leu Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Glu Tyr Thr Asn Asp Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Val Glu Phe Arg
195 200 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Leu Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
290 295 300
Asp Phe Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp

305 310 315 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
325 330 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
340 345 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
355 360 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
370 375 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385 390 395 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
405 410 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
420 425 430
Cys Val Val Val Leu Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
435 440 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
450 455 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465 470 475 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
485 490 495
Gln Thr Gly His His His His His His
500 505

<210> 803
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 803
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcagca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg atggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acgtcgagtt tcgtaaccct gcggtgaccg gggaaatcaa atattgggcg 660
cgttggctga tggaacaaac gcaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgacttcga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080

ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggtcct gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 804
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 804
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Gln Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Glu Tyr Thr Asn Asp Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Val Glu Phe Arg
195 200 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Leu Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe

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        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Phe Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Leu Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 805
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 805
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtaagca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg atggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acgtcgagtt tcgtaaccct gcggtgaccg gggaaatcaa atattgggcg 660
cgttggctga tggaacaaac gcaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
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gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgacttcga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggtcct gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 806
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 806
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Lys Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Glu Tyr Thr Asn Asp Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Val Glu Phe Arg
195 200 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Leu Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser

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                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Phe Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Leu Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 807
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 807

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ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgttgtca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg atggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
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atgggcgaga acgtcgagtt tcgtaaccct gcggtgaccg gggaaatcaa atattgggcg 660
cgttggctga tggaacaaac gcaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt ttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgacttcga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggtcct gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
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catcaccatc accattag 1518

<210> 808
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 808
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Cys Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Glu Tyr Thr Asn Asp Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Val Glu Phe Arg
195 200 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Leu Met

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    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Phe Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Leu Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 809
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 809
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360

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aaccgcgatg atcgtactca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg atggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acgtcgagtt tcgtaaccct gcggtgaccg gggaaatcaa atattgggcg 660
cgttggctga tggaacaaac gcaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgacttcga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggtcct gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattga                                              1518
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<210> 810
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 810

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            20                  25                  30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Glu Tyr Thr Asn Asp Gly Trp Asn Asp Gln Val Asp Asp
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            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Val Glu Phe Arg
        195                 200                 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Leu Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Phe Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Leu Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 811
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 811
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120

ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtagtca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg atggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acgtcgagtt tcgtaaccct gcggtgaccg gggaaatcaa atattgggcg 660
cgttggctga tggaacaaac gcaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgacttcga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggtcct gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 812
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 812
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Ser Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe

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145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Glu Tyr Thr Asn Asp Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Val Glu Phe Arg
        195                 200                 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Leu Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Phe Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Leu Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 813
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 813
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgttggca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg atggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acgtcgagtt tcgtaaccct gcggtgaccg gggaaatcaa atattgggcg 660
cgttggctga tggaacaaac gcaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgacttcga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggtcct gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 814
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 814
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100   105   110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Trp Gln Trp

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        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Glu Tyr Thr Asn Asp Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Val Glu Phe Arg
        195                 200                 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Leu Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Phe Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Leu Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 815
<211> 1518
<212> DNA

<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 815
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtatgca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg atggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acgtcgagtt tcgtaaccct gcggtgaccg gggaaatcaa atattgggcg 660
cgttggctga tggaacaaac gcaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgacttcga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc taattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggtcct gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 816
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 816
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala

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                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Met Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Glu Tyr Thr Asn Asp Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Val Glu Phe Arg
        195                 200                 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Leu Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Phe Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Leu Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 817
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 817
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtgagca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg atggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acgtcgagtt tcgtaaccct gcggtgaccg gggaaatcaa atattgggcg 660
cgttggctga tggaacaaac gcaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgacttcga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggtcct gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 818
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 818
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu

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    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Glu Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Glu Tyr Thr Asn Asp Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Val Glu Phe Arg
        195                 200                 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Leu Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Phe Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Leu Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
```

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               485                 490                 495
Gln Thr Gly His His His His His His
            500                 505


<210> 819
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 819
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtgatca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg atggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acgtcgagtt tcgtaaccct gcggtgaccg gggaaatcaa atattgggcg 660
cgttggctga tggaacaaac gcaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgacttcga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggtcct gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag                                              1518


<210> 820
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 820
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1               5                   10                  15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
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            20                  25                  30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Asp Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Glu Tyr Thr Asn Asp Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Val Glu Phe Arg
        195                 200                 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Leu Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Phe Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Leu Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
```

```
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 821
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 821
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt ttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggccggcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag                                              1518
```

<210> 822
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 822

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Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1               5                  10                  15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20                  25                  30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Arg Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
```

```
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 823
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 823

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atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt ttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaactggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag                                                1518
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<210> 824
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 824
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100   105   110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115   120   125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130   135   140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145   150   155   160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165   170   175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180   185   190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195   200   205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210   215   220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225   230   235   240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245   250   255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260   265   270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275   280   285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290   295   300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Leu Asp
305   310   315   320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325   330   335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340   345   350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355   360   365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370   375   380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385   390   395   400

```
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 825
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 825

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atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
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gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag                                              1518
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<210> 826

<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 826
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100   105   110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115   120   125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130   135   140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145   150   155   160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165   170   175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180   185   190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195   200   205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210   215   220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225   230   235   240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245   250   255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260   265   270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275   280   285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290   295   300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305   310   315   320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325   330   335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340   345   350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355   360   365

```
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Leu Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 827
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 827
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt tttaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
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catcaccatc accattag 1518

<210> 828
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 828
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
325 330 335

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Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Phe Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 829
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 829

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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaaccag 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
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gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 830
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 830
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Gln Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
290 295 300

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Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 831
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 831
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
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gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggctggcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 832
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 832
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
260 265 270

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Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Trp Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 833
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 833
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
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tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttaggggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
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catcaccatc accattag 1518

<210> 834
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 834
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Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240

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Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Arg Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 835
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 835
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaaaagggca tcttcaagat tgtcaacgac 540
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tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 836
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 836
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Lys Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205

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Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 837
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 837
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300

gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tataccttтc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
acgtgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 838
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 838
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165 170 175

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Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Thr Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 839
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 839
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcggtgaag ttatcggcca aactggccac 1500
catcaccatc accattag                                              1518
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<210> 840
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 840

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Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
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Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20                  25                  30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
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Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Gly Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 841
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>

<223> Variant of alpha-amylase from Escherichia coli

<400> 841
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgcgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 842
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 842
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100   105   110

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Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Ala Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 843
<211> 1518

<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 843
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccag gtgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt ttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 844
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 844
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80

```
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Arg Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 845
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 845
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgtgcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 846
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 846
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45

```
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Val Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
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```
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 847
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 847
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgggcaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag                                              1518
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<210> 848
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 848
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Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1               5                   10                  15
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Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20                  25                  30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Gly His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
```

```
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 849
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 849
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atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcc gtaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag                                              1518
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<210> 850
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 850
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100   105   110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115   120   125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130   135   140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145   150   155   160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165   170   175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180   185   190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195   200   205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210   215   220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225   230   235   240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245   250   255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260   265   270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275   280   285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290   295   300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305   310   315   320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325   330   335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340   345   350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355   360   365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370   375   380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385   390   395   400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405   410   415

```
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Arg Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
```

<210> 851
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 851
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atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcatttggg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag                                              1518
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<210> 852
<211> 505
<212> PRT

<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 852
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100   105   110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115   120   125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130   135   140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145   150   155   160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165   170   175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180   185   190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195   200   205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210   215   220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225   230   235   240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245   250   255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260   265   270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275   280   285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290   295   300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305   310   315   320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325   330   335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340   345   350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355   360   365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370   375   380

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Tyr Pro Ile Asp Met Pro Ile Ile Trp Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 853
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 853

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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccggt ggacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag                                              1518
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<210> 854
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 854
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325 330 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340 345 350

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Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Val Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 855
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 855

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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt ttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gactggggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
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tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 856
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 856
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320

```
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Trp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 857
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 857

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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggaccgtg 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt ttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
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gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
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catcaccatc accattag 1518

<210> 858
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 858
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Val Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
275 280 285

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Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 859
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 859
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt ttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
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cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtgctg accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 860
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 860
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255

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Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Leu Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 861
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 861

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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
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cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcggg aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 862
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 862
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
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Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220

```
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Arg Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 863
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 863
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catgggaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420

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tataccttтc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
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catcaccatc accattag                                              1518
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<210> 864
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 864

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Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1               5                  10                  15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20                  25                  30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Gly Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
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```
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 865
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 865
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180

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ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagcc gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag                                              1518
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<210> 866
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 866

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Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1               5                  10                  15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20                  25                  30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
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Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Pro Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 867
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 867
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcactaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 868
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 868
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100   105   110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115   120   125

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Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Thr Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 869
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 869
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccc tggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 870
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 870
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85   90   95

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Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Leu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 871
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 871
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg ggaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 872
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 872
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60

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Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Gly Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
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Gln Thr Gly His His His His His His
            500                 505


<210> 873
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 873
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtgggg accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag                                              1518


<210> 874
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 874
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1               5                  10                  15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20                  25                  30
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Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
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```
Arg Gln Glu Arg Val Gly Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 875
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 875
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atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt ttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtgtct accgatgaaa acggcgaggc gacctttttc 1440
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catcaccatc accattag                                              1518
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<210> 876
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 876

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1               5                  10                  15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20                  25                  30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
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Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Ser Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 877
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 877
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgggg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt ttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
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catcaccatc accattag                                              1518
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<210> 878
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 878
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Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1               5                  10                  15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20                  25                  30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Gly Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
```

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Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 879
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 879

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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
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gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
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gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
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catcaccatc accattag                                              1518
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<210> 880

<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 880
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Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100   105   110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115   120   125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130   135   140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145   150   155   160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165   170   175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180   185   190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195   200   205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210   215   220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225   230   235   240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245   250   255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260   265   270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275   280   285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290   295   300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305   310   315   320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325   330   335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340   345   350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355   360   365

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Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Arg Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 881
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 881

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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg ttaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
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catcaccatc accattag 1518

<210> 882
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 882
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1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
325 330 335

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Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Val Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 883
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 883
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
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gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacaggggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 884
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 884
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
290 295 300

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Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Arg Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 885
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 885
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtcggtatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
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gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 886
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 886
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
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Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
260 265 270

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Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Arg Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 887
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 887
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccat ttgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
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tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag                                              1518
```

<210> 888
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 888

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Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1               5                  10                  15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20                  25                  30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Ile Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
```

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Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 889
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 889
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
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tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gttggtatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 890
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 890
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205

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Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Trp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 891
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 891
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300

gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tataccttтc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagtggctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
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cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 892
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 892
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165 170 175

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Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Trp Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 893
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 893
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60

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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgggaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag                                              1518
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<210> 894
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 894

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Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1               5                  10                  15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20                  25                  30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
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Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Gly Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 895
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>

<223> Variant of alpha-amylase from Escherichia coli

<400> 895
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atggtgggat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 896
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 896
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100   105   110

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Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Trp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 897
<211> 1518

<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 897
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt ttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
cgtgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 898
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 898
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80

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Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Arg Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 899
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 899
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaggaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 900
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 900
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45

```
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Arg Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
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Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 901
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 901
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatatga acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag                                              1518
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<210> 902
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 902
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Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1               5                   10                  15
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Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20                  25                  30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
```

Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450   455   460
Arg Gln Glu Arg Val Val Thr Asp Met Asn Gly Glu Ala Thr Phe Phe
465   470   475   480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485   490   495
Gln Thr Gly His His His His His His
            500   505

<210> 903
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 903
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaagggat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag   1518

<210> 904
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 904
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100   105   110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115   120   125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130   135   140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145   150   155   160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165   170   175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180   185   190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195   200   205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210   215   220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225   230   235   240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245   250   255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260   265   270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275   280   285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290   295   300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305   310   315   320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325   330   335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340   345   350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355   360   365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370   375   380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385   390   395   400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405   410   415

```
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Gly Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 905
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 905
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgcgtact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag                                              1518
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<210> 906
<211> 505
<212> PRT

<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 906
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100   105   110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115   120   125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130   135   140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145   150   155   160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165   170   175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180   185   190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195   200   205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210   215   220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225   230   235   240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245   250   255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260   265   270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275   280   285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290   295   300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305   310   315   320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325   330   335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340   345   350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355   360   365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370   375   380

```
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Ala Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 907
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 907

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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccgt gtgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag                                              1518
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<210> 908
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 908
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Val Trp
        115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325 330 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340 345 350

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Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 909
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 909

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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgacca gggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt ttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
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tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 910
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 910
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Arg Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320

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Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 911
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 911
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atggtgtgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt ttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
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gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 912
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 912
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Cys Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
275 280 285

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Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 913
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 913

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atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtacctc ttgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt ttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
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cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
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gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 914
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 914
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Ser Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255

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Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 915
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 915
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg cttgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
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cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 916
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 916
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Ala Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220

Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
325 330 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
340 345 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
355 360 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
370 375 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385 390 395 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
405 410 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
420 425 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
435 440 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
450 455 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465 470 475 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
485 490 495
Gln Thr Gly His His His His His His
500 505

<210> 917
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 917
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420

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tataccttтc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgcgtgggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
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catcaccatc accattag                                              1518
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<210> 918
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 918

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Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
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Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20                  25                  30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
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Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Val Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 919
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 919
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180

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ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagtg gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag                                              1518
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<210> 920
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 920

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1               5                  10                  15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20                  25                  30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
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Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Trp Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 921
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 921
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
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gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gccttaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 922
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 922
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100   105   110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115   120   125

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Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Leu Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 923
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 923
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaag ggggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 924
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 924
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85   90   95

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Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Gly Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 925
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 925
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaaaggggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 926
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 926
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60

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Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Arg Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
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Gln Thr Gly His His His His His His
500 505

<210> 927
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 927
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggta cggactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 928
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 928
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30

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Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Thr
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
```

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Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 929
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 929
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcagaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt ttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
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gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag                                              1518
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<210> 930
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 930

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Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20                  25                  30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Gln Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
```

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Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
```

<210> 931
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 931
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt ttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgaggcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
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catcaccatc accattag                                              1518
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<210> 932
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 932
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100   105   110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115   120   125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130   135   140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145   150   155   160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165   170   175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180   185   190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195   200   205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210   215   220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225   230   235   240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245   250   255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260   265   270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275   280   285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290   295   300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305   310   315   320
Pro Arg His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325   330   335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340   345   350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355   360   365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370   375   380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385   390   395   400

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Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 933
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 933
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag gggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tacagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag                                              1518
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<210> 934

<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 934
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100   105   110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115   120   125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130   135   140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145   150   155   160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165   170   175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180   185   190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195   200   205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210   215   220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225   230   235   240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Gly Val Ser
                245   250   255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260   265   270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275   280   285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290   295   300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305   310   315   320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325   330   335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340   345   350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355   360   365

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Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 935
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 935

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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gctggaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
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catcaccatc accattag 1518

<210> 936
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 936
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
325 330 335

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Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Trp Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 937
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 937

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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacccg 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
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gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 938
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 938
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Pro Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
290 295 300

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Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 939
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 939
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
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gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
tgggatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 940
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 940
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
260 265 270

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Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Trp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 941
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 941
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
gtgtgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
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```
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
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catcaccatc accattag                                              1518
```

<210> 942
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 942

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Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1               5                  10                  15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20                  25                  30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Val Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
```

```
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 943
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 943
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
```

tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgggttt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 944
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 944
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205

```
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Gly Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 945
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 945
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300

gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tataccttтc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccggg ggacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 946
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 946
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1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165 170 175

```
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Gly Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 947
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 947
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60

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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaacggt gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
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catcaccatc accattag                                              1518
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<210> 948
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 948

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Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1               5                  10                  15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20                  25                  30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
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Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn Gly Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 949
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>

<223> Variant of alpha-amylase from Escherichia coli

<400> 949
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgctgtg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 950
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 950
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100   105   110

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Glu His Ile Arg Val Gln Arg Val Asn Arg Cys Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 951
<211> 1518

<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 951
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt ttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa tgtacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 952
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 952
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80

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Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Met
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 953
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 953
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtcagca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 954
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 954
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45

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Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Gln Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
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Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
485 490 495
Gln Thr Gly His His His His His His
500 505

<210> 955
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 955
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattt tttgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 956
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 956
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15

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Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20                  25                  30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Phe Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
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Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 957
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 957
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
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catcaccatc accattag                                              1518
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<210> 958
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 958
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100   105   110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115   120   125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130   135   140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145   150   155   160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165   170   175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180   185   190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195   200   205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210   215   220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225   230   235   240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245   250   255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260   265   270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275   280   285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290   295   300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305   310   315   320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325   330   335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340   345   350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355   360   365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370   375   380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385   390   395   400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405   410   415

```
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Cys Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 959
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 959
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgcgggggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag                                              1518
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<210> 960
<211> 505
<212> PRT

<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 960
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100   105   110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115   120   125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130   135   140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145   150   155   160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165   170   175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180   185   190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195   200   205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210   215   220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225   230   235   240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245   250   255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260   265   270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275   280   285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gly Gly Arg
    290   295   300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305   310   315   320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325   330   335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340   345   350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355   360   365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370   375   380

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Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 961
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 961

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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagcgtctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag                                              1518
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<210> 962
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 962
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100   105   110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115   120   125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130   135   140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145   150   155   160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165   170   175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180   185   190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195   200   205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210   215   220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225   230   235   240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245   250   255
Pro Lys Arg Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260   265   270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275   280   285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290   295   300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305   310   315   320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325   330   335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340   345   350

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Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 963
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 963

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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt ttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
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cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggtgggac 1380
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tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatcggcca aactggccac 1500
catcaccatc accattag 1518

<210> 964
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 964
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320

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Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Trp Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 965
<211> 1518
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 965

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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt ttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtcagtatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
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gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
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catcaccatc accattag 1518

<210> 966
<211> 505
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 966
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Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
275 280 285

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Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Gln Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile Gly
                485                 490                 495
Gln Thr Gly His His His His His His
            500                 505
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<210> 967
<211> 2001
<212> DNA
<213> Artificial Sequence

<220>
<223> Wild type serine endopeptidase from Microcoleus sp. PCC 7113

<400> 967

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gtgaccagcg ttagcccgga ggcgcgtaac atcctggacc agttcgagct ggaaacccgt 180
tttcgtgcgg cgggtgtgga gattctgcgt gcgaaggacc cgcgtgaaaa cagcgcgctg 240
cgtgataccg cgcgtgttat cctgaaccag gaaccggcga ttcaattcgc gggccgtgtg 300
ctggttgatc cgcagagcat gcaaccggtg gtttacaccg agaacatctt cgtgaagttt 360
gacgatgaaa cccagagcgg tgcgtgccaa gagatcctgg aacgttatgg cctgaccatt 420
aaacgtgagc tgggttacgc gcgtaacgcg tatttcgtta gcgcgccgga aaacaccggc 480
ctgaccatct ttgacattgc gagccgtctg ctgaacgagg aaagcgtgga gctgtgccac 540
ccggagctgg ttcgtgaaat caacaagcgt caggcgttcc cgcagcaatg gcacctgaaa 600
ccgaccacca tccgcggtca agcgattaac gcggatgcga acgtggaagc ggcgtggagc 660
ctgagcaacg gtaccggtac caccatcgcg atcattgacg atggcgtgga cctggaccac 720
gaggaatttc gtaccgcggg taaaattgtg gcgccgcgtg acgttacccg taagaccaac 780
gacccgcgtc cgggtaaccg tgataaccat ggtaccgcgt gcgcgggtgt ggcgtgcgcg 840
aacggtaacg ttggtgcgag cggtgttgcg ccgggtgcgc gtctgatgcc gatccgtttc 900
gtcagcggtc tgggcagcca ggaggaagcg gatgcgtttg tttgggcggc gcaaaacggt 960
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gcggatgtta ttagctgcag ctggggtccg ccggacggtg tttggtacaa cccgtgggat 1020
ccgcgccaca accagaagtt tccgctgccg gacagcaccc gtctggcgat ggatttcgcg 1080
atcaaccaag gccgtaacgg taaaggctgc gtgattctgt ttgcggcggg taacggcaac 1140
gagagcgttg acaacgatgg ttacgcgagc tatgaaaagg tgatcgcggt tgcggcgtgc 1200
aacgacagca gcgtcaaaag cgtctatagc gatttcggca acgcggtttg gtgcgcgttt 1260
ccgagcaacg acggccgtcc tagcaaaacc ccgggtattt ggaccaccga tcgtatgggc 1320
cgtctgggtt acaaccgggg taacctgcgc cagggtgatg cggcgggtaa ctataccaac 1380
agctttggtg gcaccagcag ctcgtgcccg ggtgcggcgg gtgtggcggc gctgatcatt 1440
gcgcgtaacc cgaacctgcg ttgggaagag gttcgtgaga tcattaagca aagctgcgac 1500
cgtatcgatc aagcaggtgg caactacgat gcgagtggtc atagcccgtt ctacggttat 1560
ggccgtatga acgcgcgtaa ggcggtggaa ctggcgatgc cggagtggcc aagcccggtt 1620
agtatcttta ccatcgtgca ggacgttccg attaaagatc tggaaaccag caccctgacc 1680
ctggcgatcg cgaacaccga cctgatcaag agcattaaag tgagcgttga catcgaacac 1740
ctgcgtatcg gcgatctggt ggttaccctg aaggcgccgg tggagatggg cgttgatccg 1800
atgctgctgc acaaccgtga gggtgcggcg accgacaaca ttaagaaaac ctatgatgta 1860
gtgaacgcgc cgggtctggc ggcgtgcaag ggcaaaagcc cgcagggtac ctggaccctg 1920
gaagttgccg ataaagtgca gcgtgacatt ggcaagatgc gtagctttac cctggaactg 1980
ggctttgagc aaccgagcta g 2001

<210> 968
<211> 666
<212> PRT
<213> Artificial Sequence

<220>
<223> Wild type serine endopeptidase from Microcoleus sp. PCC 7113

<400> 968
Met Val Thr Val Arg Tyr Gly Gly Arg Asn Gly Glu Pro Tyr Glu Leu
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Thr Ile Ser Asp Glu His Ile Val Val Arg Thr Glu Asn Arg Ser Ile
20 25 30
Leu Thr Glu Thr Arg Pro Tyr Glu Val Thr Ser Val Ser Pro Glu Ala
35 40 45
Arg Asn Ile Leu Asp Gln Phe Glu Leu Glu Thr Arg Phe Arg Ala Ala
50 55 60
Gly Val Glu Ile Leu Arg Ala Lys Asp Pro Arg Glu Asn Ser Ala Leu
65 70 75 80
Arg Asp Thr Ala Arg Val Ile Leu Asn Gln Glu Pro Ala Ile Gln Phe
85 90 95
Ala Gly Arg Val Leu Val Asp Pro Gln Ser Met Gln Pro Val Val Tyr
100 105 110
Thr Glu Asn Ile Phe Val Lys Phe Asp Asp Glu Thr Gln Ser Gly Ala
115 120 125
Cys Gln Glu Ile Leu Glu Arg Tyr Gly Leu Thr Ile Lys Arg Glu Leu
130 135 140
Gly Tyr Ala Arg Asn Ala Tyr Phe Val Ser Ala Pro Glu Asn Thr Gly
145 150 155 160
Leu Thr Ile Phe Asp Ile Ala Ser Arg Leu Leu Asn Glu Glu Ser Val
165 170 175
Glu Leu Cys His Pro Glu Leu Val Arg Glu Ile Asn Lys Arg Gln Ala
180 185 190
Phe Pro Gln Gln Trp His Leu Lys Pro Thr Thr Ile Arg Gly Gln Ala

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        195                 200                 205
Ile Asn Ala Asp Ala Asn Val Glu Ala Ala Trp Ser Leu Ser Asn Gly
    210                 215                 220
Thr Gly Thr Thr Ile Ala Ile Ile Asp Asp Gly Val Asp Leu Asp His
225                 230                 235                 240
Glu Glu Phe Arg Thr Ala Gly Lys Ile Val Ala Pro Arg Asp Val Thr
                245                 250                 255
Arg Lys Thr Asn Asp Pro Arg Pro Gly Asn Arg Asp Asn His Gly Thr
            260                 265                 270
Ala Cys Ala Gly Val Ala Cys Ala Asn Gly Asn Val Gly Ala Ser Gly
        275                 280                 285
Val Ala Pro Gly Ala Arg Leu Met Pro Ile Arg Phe Val Ser Gly Leu
    290                 295                 300
Gly Ser Gln Glu Glu Ala Asp Ala Phe Val Trp Ala Ala Gln Asn Gly
305                 310                 315                 320
Ala Asp Val Ile Ser Cys Ser Trp Gly Pro Pro Asp Gly Val Trp Tyr
                325                 330                 335
Asn Pro Trp Asp Pro Arg His Asn Gln Lys Phe Pro Leu Pro Asp Ser
            340                 345                 350
Thr Arg Leu Ala Met Asp Phe Ala Ile Asn Gln Gly Arg Asn Gly Lys
        355                 360                 365
Gly Cys Val Ile Leu Phe Ala Ala Gly Asn Gly Asn Glu Ser Val Asp
    370                 375                 380
Asn Asp Gly Tyr Ala Ser Tyr Glu Lys Val Ile Ala Val Ala Ala Cys
385                 390                 395                 400
Asn Asp Ser Ser Val Lys Ser Val Tyr Ser Asp Phe Gly Asn Ala Val
                405                 410                 415
Trp Cys Ala Phe Pro Ser Asn Asp Gly Arg Pro Ser Lys Thr Pro Gly
            420                 425                 430
Ile Trp Thr Thr Asp Arg Met Gly Arg Leu Gly Tyr Asn Arg Gly Asn
        435                 440                 445
Leu Arg Gln Gly Asp Ala Ala Gly Asn Tyr Thr Asn Ser Phe Gly Gly
    450                 455                 460
Thr Ser Ser Ser Cys Pro Gly Ala Ala Gly Val Ala Ala Leu Ile Ile
465                 470                 475                 480
Ala Arg Asn Pro Asn Leu Arg Trp Glu Glu Val Arg Glu Ile Ile Lys
                485                 490                 495
Gln Ser Cys Asp Arg Ile Asp Gln Ala Gly Gly Asn Tyr Asp Ala Ser
            500                 505                 510
Gly His Ser Pro Phe Tyr Gly Tyr Gly Arg Met Asn Ala Arg Lys Ala
        515                 520                 525
Val Glu Leu Ala Met Pro Glu Trp Pro Ser Pro Val Ser Ile Phe Thr
    530                 535                 540
Ile Val Gln Asp Val Pro Ile Lys Asp Leu Glu Thr Ser Thr Leu Thr
545                 550                 555                 560
Leu Ala Ile Ala Asn Thr Asp Leu Ile Lys Ser Ile Lys Val Ser Val
                565                 570                 575
Asp Ile Glu His Leu Arg Ile Gly Asp Leu Val Val Thr Leu Lys Ala
            580                 585                 590
Pro Val Glu Met Gly Val Asp Pro Met Leu Leu His Asn Arg Glu Gly
        595                 600                 605
Ala Ala Thr Asp Asn Ile Lys Lys Thr Tyr Asp Val Val Asn Ala Pro
    610                 615                 620
Gly Leu Ala Ala Cys Lys Gly Lys Ser Pro Gln Gly Thr Trp Thr Leu
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625 630 635 640
Glu Val Ala Asp Lys Val Gln Arg Asp Ile Gly Lys Met Arg Ser Phe
645 650 655
Thr Leu Glu Leu Gly Phe Glu Gln Pro Ser
660 665

<210> 969
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 969
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggactt ccggtgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggttgcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttgataagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtatgggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg tatggtgcgc actacgaaga tgtgggtggc 1140
gacggccaga cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accctgttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggtt accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag 1488

<210> 970
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 970
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Glu

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Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Asp Gly Phe Asn
            20                  25                  30
Asp Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
        115                 120                 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Phe Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ala
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Asp
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Met Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Tyr Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Gln Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Leu Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
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```
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 971
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 971
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagtatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggactt caaatgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggttgcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttgacaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtatgggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
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gcgcgtcagc gtttcgcgca cggcgttcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggtt accgatgaga acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag              1488
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<210> 972
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 972

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1               5                  10                  15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Asp Gly Phe Asn
            20                  25                  30
Asp Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
        115                 120                 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Phe Lys Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ala
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Asp
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Met Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Tyr Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Gln Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu His Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
```

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Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 973
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 973

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tggccggagc tggcggagcg tgcggacggt ttcaacgaca tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggactt caaatgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggttgcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttgacaagc tgcagaccta cattgatcaa 840
gttgagggtt cgaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtatgggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg tatggtgcgc actacgaaga tgtgggtggc 1140
gacggccaga cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accctgttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggtt accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag              1488
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<210> 974
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 974
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Glu
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Asp Gly Phe Asn
            20   25   30
Asp Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100   105   110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
        115   120   125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130   135   140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Phe Lys Cys Phe
145   150   155   160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165   170   175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180   185   190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195   200   205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210   215   220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225   230   235   240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ala
                245   250   255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Asp
            260   265   270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Ser Thr Met Leu Phe
        275   280   285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Met Gly Arg
    290   295   300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305   310   315   320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325   330   335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340   345   350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355   360   365
Asp Leu Tyr Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Gln Thr
    370   375   380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385   390   395   400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Leu Phe Phe Asp His
                405   410   415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly

```
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 975
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 975

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tggccggagc tggcggcgct ggcggacggt ttcaacgaca tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggactt caaatgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggttgcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttgacaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtatgggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg tatggtgcgc actacgaaga tgtgggtggc 1140
gacggccaga cctacccgat cgatatgccg atcattgagc aactggacga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgacgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcaaga gcgtgtggtt accgatgaga acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag              1488
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<210> 976
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 976
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Glu
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Leu Ala Asp Gly Phe Asn
            20   25   30
Asp Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100   105   110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
        115   120   125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130   135   140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Phe Lys Cys Phe
145   150   155   160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165   170   175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180   185   190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195   200   205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210   215   220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225   230   235   240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ala
                245   250   255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Asp
            260   265   270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275   280   285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Met Gly Arg
    290   295   300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305   310   315   320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325   330   335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340   345   350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355   360   365
Asp Leu Tyr Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Gln Thr
    370   375   380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385   390   395   400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405   410   415

```
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 977
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 977
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atgcgtaacc cgaccctgct gcaatgcttt cactggtact acccggaagg cggtaaactg 60
tggccggagc tggcggagcg tgcggacggt ttcaacgaca tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggactt caaatgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggttgcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggtaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtatgggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg tatggtgcgc actacgaaga tgtgggtggc 1140
gacggccaga cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accctgttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggtt accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag              1488
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<210> 978
<211> 495
<212> PRT
<213> Artificial Sequence

<220>

<223> Variant of alpha-amylase from Escherichia coli

<400> 978

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1               5                  10                  15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Asp Gly Phe Asn
            20                  25                  30
Asp Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
        115                 120                 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Phe Lys Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ala
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Met Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Tyr Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Gln Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Leu Phe Phe Asp His
```

```
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 979
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 979
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atgcgtaacc cgaccctgct gcaatgcttt cactggtact acccggaagg cggtaaactg 60
tggccggagc tggcggagcg tgcggacggt ttcaacgata tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcattg caaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggactt taaatgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggttgcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttgacaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtatgggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcga gctacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accctgttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggtt accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggatg ttatctag              1488
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<210> 980
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 980
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Glu
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Asp Gly Phe Asn
            20   25   30
Asp Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Ala Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100   105   110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
        115   120   125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130   135   140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Phe Lys Cys Phe
145   150   155   160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165   170   175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180   185   190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195   200   205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210   215   220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225   230   235   240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ala
                245   250   255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Asp
            260   265   270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275   280   285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Met Gly Arg
    290   295   300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305   310   315   320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325   330   335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340   345   350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355   360   365
Asp Leu Phe Gly Ala Ser Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370   375   380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385   390   395   400

Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Leu Phe Phe Asp His
405 410 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
420 425 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
435 440 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
450 455 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465 470 475 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Asp Val Ile
485 490 495

<210> 981
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 981
atgcgtaacc cgaccctgct gcaatgcttt cactggtact acccggaagg cggtaagctg 60
tggccggagc tggcggcgct ggcggacggt ttcaacgaca tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagtatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggactt caaatgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggttgcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttgacaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtatgggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg tatggtgcgc actacgaaga tgtgggtggc 1140
gacggccaga cctacccgat cgatatgccg atcattgagc aactggacga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accctgttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtgaaga gcgtgtggtt accgatgata acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag 1488

<210> 982
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 982
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Glu
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Leu Ala Asp Gly Phe Asn
            20   25   30
Asp Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100   105   110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
        115   120   125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130   135   140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Phe Lys Cys Phe
145   150   155   160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165   170   175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180   185   190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195   200   205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210   215   220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225   230   235   240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ala
                245   250   255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Asp
            260   265   270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275   280   285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Met Gly Arg
    290   295   300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305   310   315   320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325   330   335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340   345   350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355   360   365
Asp Leu Tyr Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Gln Thr
    370   375   380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu

385 390 395 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Leu Phe Phe Asp His
405 410 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
420 425 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
435 440 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
450 455 460
Arg Glu Glu Arg Val Val Thr Asp Asp Asn Gly Glu Ala Thr Phe Phe
465 470 475 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
485 490 495

<210> 983
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 983
atgcgtaacc cgaccctgct gcaatgcttt cactggtact acccggaagg cggtaaactg 60
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggactt caaatgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggttgcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttgacaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtatgggtc gtgactatga tatgacccaa atcttcaccg gcaccctggg ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg tatggtgcgc actacgaaga tgtgggtggc 1140
gacggcttga cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accctgttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggtt accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag 1488

<210> 984
<211> 495
<212> PRT

<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 984
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Glu
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Asp Gly Phe Asn
            20   25   30
Asp Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100   105   110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
        115   120   125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130   135   140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Phe Lys Cys Phe
145   150   155   160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165   170   175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180   185   190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195   200   205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210   215   220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225   230   235   240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ala
                245   250   255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Asp
            260   265   270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275   280   285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Met Gly Arg
    290   295   300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Gly Glu Ala Asp
305   310   315   320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325   330   335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340   345   350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355   360   365
Asp Leu Tyr Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Leu Thr
    370   375   380

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Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Leu Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 985
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 985
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tggccggagc tggcggagcg tgcggacggt ttcaacgaca tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagtatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggactt caaatgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggttgcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttgacaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtatgggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg tatggtgcgc actacgaaga tgtgggtggc 1140
gacggccaga cctacccgat cgacatgccg atcattgagc aactgcacga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgaagaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtgaaga gcgtgtggtt accgatgaga acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag              1488
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<210> 986
<211> 495

<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 986
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Glu
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Asp Gly Phe Asn
            20   25   30
Asp Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100   105   110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
        115   120   125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130   135   140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Phe Lys Cys Phe
145   150   155   160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165   170   175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180   185   190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195   200   205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210   215   220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225   230   235   240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ala
                245   250   255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Asp
            260   265   270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275   280   285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Met Gly Arg
    290   295   300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305   310   315   320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325   330   335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340   345   350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355   360   365
Asp Leu Tyr Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Gln Thr

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    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu His Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Glu Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Glu Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 987
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 987
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tggccggagc tggcggagcg tgcggacggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta taaatgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttgacaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accctgttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag              1488
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<210> 988

<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 988
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Asp Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100   105   110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
        115   120   125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130   135   140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Lys Cys Phe
145   150   155   160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165   170   175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180   185   190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195   200   205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210   215   220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225   230   235   240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245   250   255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Asp
            260   265   270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275   280   285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290   295   300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305   310   315   320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325   330   335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340   345   350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355   360   365

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Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Leu Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 989
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 989

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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggactt caaatgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggttgcggg gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttgacaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtatgggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg tatggtgcgc actacgaaga tgtgggtggc 1140
gacggccaga cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accctgttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggtt accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag              1488
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<210> 990
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 990
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Glu
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Asp Gly Phe Asn
            20   25   30
Asp Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100   105   110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
        115   120   125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130   135   140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Phe Lys Cys Phe
145   150   155   160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165   170   175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180   185   190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195   200   205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210   215   220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225   230   235   240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ala
                245   250   255
Gly Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Asp
            260   265   270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275   280   285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Met Gly Arg
    290   295   300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305   310   315   320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325   330   335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340   345   350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro

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        355                 360                 365
Asp Leu Tyr Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Gln Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Leu Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 991
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 991
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggactt caaatgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggttgcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttgacaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtatgggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg tatggtgcgc actacgaaga tgtgggtggc 1140
gacggccaga cctacccgat cgaaatgccg atcattgagc aactgcacga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgaagaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggtt accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag              1488
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<210> 992
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 992
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Glu
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Asp Gly Phe Asn
            20   25   30
Asp Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100   105   110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
        115   120   125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130   135   140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Phe Lys Cys Phe
145   150   155   160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165   170   175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180   185   190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195   200   205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210   215   220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225   230   235   240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ala
                245   250   255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Asp
            260   265   270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275   280   285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Met Gly Arg
    290   295   300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305   310   315   320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325   330   335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340   345   350

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Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Tyr Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Gln Thr
    370                 375                 380
Tyr Pro Ile Glu Met Pro Ile Ile Glu Gln Leu His Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Glu Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 993
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 993

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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggactt caaatgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggttgcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttgacaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtatgggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg tatggtgcgc actacgaaga tgtgggtggc 1140
gacggccaga cctacccgat cgatatgccg atcattgagc aactgcacga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgaagaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcaaga gcgtgtggtt accgatgata acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag              1488
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<210> 994
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 994
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Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Leu Ala Asp Gly Phe Asn
20 25 30
Asp Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
115 120 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Phe Lys Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ala
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Asp
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Met Gly Arg
290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
325 330 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr

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            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Tyr Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Gln Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu His Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Glu Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Asp Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 995
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 995

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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggcaggtac agccaattta tctgggactt caaatgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggttgcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttgacaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtatgggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg tatggtgcgc actacgaaga tgtgggtggc 1140
gacggccaga cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accctgttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggtt accgatgaaa acggcgaggc gacctttttc 1440
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tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag 1488

<210> 996
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 996
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Glu
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Asp Gly Phe Asn
20 25 30
Asp Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
115 120 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Arg Tyr Ser Gln Phe Ile Trp Asp Phe Lys Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ala
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Asp
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Met Gly Arg
290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
325 330 335

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Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Tyr Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Gln Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Leu Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 997
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 997

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tggccggagc tggcggagcg tgcggacggt ttcaacgaca tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggactt caaatgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttgacaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtatgggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg tatggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accctgttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
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tttctgggta accgtcagga gcgtgtggtt accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag 1488

<210> 998
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 998
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Glu
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Asp Gly Phe Asn
20 25 30
Asp Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
115 120 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Phe Lys Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Asp
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Met Gly Arg
290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu

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                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Tyr Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Leu Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 999
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 999
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atgcgtaacc cgaccctgct gcaatgcttt cactggtact acccggaagg cggtaaactg 60
tggccggagc tggcggagcg tgcggacggt ttcaacgata tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcattc caaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgac gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggactt taaatgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttgacaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtatgggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg tacggtgcgc actacgaaga tgtgggtggc 1140
gacggccaga cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accctgttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
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gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggatg ttatctag 1488

<210> 1000
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1000
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Glu
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Asp Gly Phe Asn
20 25 30
Asp Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Phe Lys Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Asp
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Met Gly Arg
290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320

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Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Tyr Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Gln Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Leu Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Asp Val Ile
                485                 490                 495
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<210> 1001
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1001

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tggccggagc tggcggagcg tgcggacggt ttcaacgaca tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggactt caaatgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggttgcgga gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttgacaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtatgggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg tatggtgcgc actacgaaga tgtgggtggc 1140
gacggccaga cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accctgttct ttgaccaccc gaactgcatc 1260
```

gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggtt accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag 1488

<210> 1002
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1002
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Glu
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Asp Gly Phe Asn
20 25 30
Asp Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
115 120 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Phe Lys Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ala
245 250 255
Glu Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Asp
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Met Gly Arg
290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp

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305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Tyr Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Gln Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Leu Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1003
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1003
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atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggagcg tgcggacggt ttcaacgaca tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggactt taaatgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttgacaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg tacggtgcga gctacgaaga tgtgggtggc 1140
gacggccaga cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
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gcgcgtcagc gtttcgcgca cggcgttcaa accctgttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggagg ttatctag 1488

<210> 1004
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1004
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Asp Gly Phe Asn
20 25 30
Asp Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
115 120 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Phe Lys Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Asp
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
290 295 300

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Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Tyr Gly Ala Ser Tyr Glu Asp Val Gly Gly Asp Gly Gln Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Leu Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1005
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1005
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atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggaagg cggtaaactg 60
tggccggagc tggcggagcg tgcggacggt ttcaacgata tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcgttc caaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgac gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggactt taaatgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttgacaagc tgcagaccta cattgatcaa 840
gttgatggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg tacggtgcgc actacgaaga tgtgggtggc 1140
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gacggccaga cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accctgttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggatg ttatctag 1488

<210> 1006
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1006
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Glu
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Asp Gly Phe Asn
20 25 30
Asp Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Val Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Phe Lys Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Asp
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Asp Gly Lys Thr Met Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg

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    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Tyr Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Gln Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Leu Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Asp Val Ile
                485                 490                 495
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<210> 1007
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1007
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atgcgtaacc cgaccctgct gcaatgcttt cactggtact acccggaagg cggtaaactg 60
tggccggagc tggcggagcg tgcggacggt ttcaacgaca tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggactt caaatgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggttgcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttaagaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtatgggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
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ggtgtgccga gcgtgttcta cccggacctg tatggtgcgc actacgaaga tgtgggtggc 1140
gacggccaga cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accctgttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggtt accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag 1488

<210> 1008
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1008
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Glu
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Asp Gly Phe Asn
20 25 30
Asp Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
115 120 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Phe Lys Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ala
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Lys
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
275 280 285

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Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Met Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Tyr Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Gln Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Leu Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1009
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1009
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tggccggagc tggcggagcg tgcggacggt ttcaacgaca tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcgttg caaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggactt caaatgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttgacaagc tgcagaccta cattgatcaa 840
gttgatggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtatgggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
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gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattttact gcgtgagaac 1080
ggtgtgccga gcgtgttgta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accctgttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggatg ttatctag 1488

<210> 1010
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1010
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Asp Gly Phe Asn
20 25 30
Asp Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Val Ala Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
115 120 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Phe Lys Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Asp
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Asp Gly Lys Thr Met Leu Phe

```
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Met Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Leu Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Leu Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Asp Val Ile
                485                 490                 495
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<210> 1011
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1011
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atgcgtaacc cgaccctgct gcaatgcttt cactggtact acccggaagg cggtaaactg 60
tggccggagc tggcggagcg tgcggacggt ttcaacgaca tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggactt caaatgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggttgcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttgacaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtatgggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
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ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg tatggtgcgc actacgaaga tgtgggtggc 1140
gacggccaga cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa acctcgttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggtt accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag 1488

<210> 1012
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1012
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Glu
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Asp Gly Phe Asn
20 25 30
Asp Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
115 120 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Phe Lys Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ala
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Asp
260 265 270

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Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Met Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Tyr Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Gln Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Ser Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1013
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1013
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atgcgtaacc cgaccctgct gcaatgcttt cactggtact acccggaagg cggtaaactg 60
tggccggagc tggcggagcg tgcggacggt ttcaacgaca tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggactt caaatgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggttgcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttgacaagc tgcagaccta cattgatcaa 840
gttgagggtc ggaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
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cgtatgggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg tatggtgcgc actacgaaga tgtgggtggc 1140
gacggccaga cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accctgttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggtt accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag 1488

<210> 1014
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1014
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Glu
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Asp Gly Phe Asn
20 25 30
Asp Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
115 120 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Phe Lys Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ala
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Asp

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            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Arg Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Met Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Tyr Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Gln Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Leu Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1015
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1015
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atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggagcg tgcggacggt ttcaacgata tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcgttc caaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggactt taaatgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttgacaagc tgcagaccta cattgatcaa 840
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gttgatggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cccgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accctgttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggtt accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag 1488

<210> 1016
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1016
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Asp Gly Phe Asn
20 25 30
Asp Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Val Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
115 120 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Phe Lys Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255

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Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Asp
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Asp Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn Pro Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Leu Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1017
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1017
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tggccggagc tggcggagcg tgcggacggt ttcaacgaca tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggactt caaatgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggttgcgcc gaagccgctg 780
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tttatcgtgg cggagtattg gagccacgaa gttagtaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtatgggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg tatggtgcgc actacgaaga tgtgggtggc 1140
gacggccaga cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accctgttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggtt accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag 1488

<210> 1018
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1018
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Glu
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Asp Gly Phe Asn
20 25 30
Asp Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
115 120 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Phe Lys Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ala

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                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Ser
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Met Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Tyr Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Gln Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Leu Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1019
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1019
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tggccggagc tggcggagcg tgcgaggggt ttcaacgaca tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggactt caaatgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720

ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggttgcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttgacaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtatgggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg tatggtgcgc actacgaaga tgtgggtggc 1140
gacggccaga cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accctgttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggtt accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag 1488

<210> 1020
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1020
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Glu
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Arg Gly Phe Asn
20 25 30
Asp Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
115 120 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Phe Lys Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240

Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ala
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Asp
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Met Gly Arg
290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
325 330 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
340 345 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
355 360 365
Asp Leu Tyr Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Gln Thr
370 375 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385 390 395 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Leu Phe Phe Asp His
405 410 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
420 425 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
435 440 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
450 455 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465 470 475 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
485 490 495

<210> 1021
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1021
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggactt caaatgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660

cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggttgcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttccgaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtatgggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg tatggtgcgc actacgaaga tgtgggtggc 1140
gacggccaga cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accctgttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggtt accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag 1488

<210> 1022
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1022
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Glu
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Asp Gly Phe Asn
20 25 30
Asp Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
115 120 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Phe Lys Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile

225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ala
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Pro
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Met Gly Arg
290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
325 330 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
340 345 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
355 360 365
Asp Leu Tyr Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Gln Thr
370 375 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385 390 395 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Leu Phe Phe Asp His
405 410 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
420 425 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
435 440 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
450 455 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465 470 475 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
485 490 495

<210> 1023
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1023
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tggccggagc tggcggagcg tgcggacggt ttcaacgaca tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggactt caaatgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600

atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggttgcgcg gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttgacaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtatgggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg tatggtgcgc actacgaaga tgtgggtggc 1140
gacggccaga cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accctgttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggtt accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag 1488

<210> 1024
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1024
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Glu
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Asp Gly Phe Asn
20 25 30
Asp Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
115 120 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Phe Lys Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220

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Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ala
                245                 250                 255
Arg Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Asp
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Met Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Tyr Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Gln Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Leu Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495


<210> 1025
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1025
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggactt caaatgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
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tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggttgcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttgacaagc tgcagaccta cattcggcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtatgggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg tatggtgcgc actacgaaga tgtgggtggc 1140
gacggccaga cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accctgttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggtt accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag 1488

<210> 1026
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1026
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Glu
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Asp Gly Phe Asn
20 25 30
Asp Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
115 120 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Phe Lys Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met

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    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ala
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Asp
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Arg Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Met Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Tyr Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Gln Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Leu Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1027
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1027
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tataccttc cggcgcgtgc gggccagtac agccaattta tctgggactt caaatgcttt 480

agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggttgcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttaggaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtatgggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg tatggtgcgc actacgaaga tgtgggtggc 1140
gacggccaga cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accctgttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggtt accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag 1488

<210> 1028
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1028
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Glu
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Asp Gly Phe Asn
20 25 30
Asp Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
115 120 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Phe Lys Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205

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Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ala
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Arg
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Met Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Tyr Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Gln Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Leu Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1029
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1029
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tggccggagc tggcggagcg tgcggacggt ttcaacgaca tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420

tataccttтc cggcgcgtgc gggccagtac agccaattta tctgggactt caaatgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggttgcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttgacaagc tgcagaccta cattgatcaa 840
gttgagggtt gtaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtatgggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg tatggtgcgc actacgaaga tgtgggtggc 1140
gacggccaga cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accctgttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggtt accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag 1488

<210> 1030
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1030
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1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Asp Gly Phe Asn
20 25 30
Asp Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
115 120 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Phe Lys Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg

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        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ala
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Asp
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Cys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Met Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Tyr Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Gln Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Leu Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1031
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1031
atgcgtaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggagcg tgcggacggt ttcaacgaca tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360

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aacgcggacg atcgtaccca aattgatgac gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggactt taaatgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttgacaagc tgcagcaata cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtatgggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg tacggtgcga gctacgaaga tgtgggtggc 1140
gacggccaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accctgttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtgacg accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggagg ttatctag              1488
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<210> 1032
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1032

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Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1               5                  10                  15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Asp Gly Phe Asn
            20                  25                  30
Asp Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Phe Lys Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
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Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Asp
            260                 265                 270
Lys Leu Gln Gln Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Met Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Tyr Gly Ala Ser Tyr Glu Asp Val Gly Gly Asp Gly Gln Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Leu Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Thr Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1033
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1033
atgcgtaacc cgaccctgct gcaatgcttt cactggtact acccggaagg cggtaaactg 60
tggccggagc tggcggagcg tgcggacggt ttcaacgaca tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300

gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggactt caaatgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggttgcgtc taagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttgacaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtatgggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg tatggtgcgc actacgaaga tgtgggtggc 1140
gacggccaga cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accctgttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggtt accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag 1488

<210> 1034
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1034
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Glu
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Asp Gly Phe Asn
20 25 30
Asp Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
115 120 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Phe Lys Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp

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            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ala
                245                 250                 255
Ser Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Asp
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Met Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Tyr Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Gln Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Leu Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1035
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1035
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tggccggagc tggcggagcg tgcggacggt ttcaacgaca tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240

gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggactt caaatgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggttgcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttgacaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtatgggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg tatggtgcgc actacgaaga tgtgggtggc 1140
gacggccaga cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggctctcaa accctgttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggtt accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag 1488

<210> 1036
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1036
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Glu
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Asp Gly Phe Asn
20 25 30
Asp Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
115 120 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Phe Lys Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175

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Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ala
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Asp
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Met Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Tyr Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Gln Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Ser Gln Thr Leu Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1037
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1037
atgcgtaacc cgaccctgct gcaatgcttt cactggtact acccggaagg cggtaaactg 60
tggccggagc tggcggagcg tgcggacggt ttcaacgaca tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180

ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggactt caaatgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaaa gtgttgcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttgacaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtatgggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg tatggtgcgc actacgaaga tgtgggtggc 1140
gacggccaga cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accctgttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggtt accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag 1488

<210> 1038
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1038
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Glu
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Asp Gly Phe Asn
20 25 30
Asp Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
115 120 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Phe Lys Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys

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                165                 170                 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Ser Val Ala
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Asp
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Met Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Tyr Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Gln Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Leu Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1039
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1039
atgcgtaacc cgaccctgct gcaatgcttt cactggtact acccggaagg cggtaaactg 60
tggccggagc tggcggagcg tgcggacggt ttcaacgaca tcggcattaa catggtgtgg 120

ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggactt caaatgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggttgcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttgacaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtatgggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg tatggtgcgc actacgaaga tgtgggtggc 1140
gacggccaga cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accctgttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggtt accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttgagtag 1488

<210> 1040
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1040
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Glu
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Asp Gly Phe Asn
20 25 30
Asp Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
115 120 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Phe Lys Cys Phe
145 150 155 160

Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ala
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Asp
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Met Gly Arg
290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
325 330 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
340 345 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
355 360 365
Asp Leu Tyr Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Gln Thr
370 375 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385 390 395 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Leu Phe Phe Asp His
405 410 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
420 425 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
435 440 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
450 455 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465 470 475 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Glu
485 490 495

<210> 1041
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1041
atgcgtaacc cgaccctgct gcaatgcttt cactggtact acccggaagg cggtgagctg 60

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tggccggagc tggcggagcg tgcggacggt ttcaacgaca tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcactatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggactt caaatgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggttgcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttgacaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtatgggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aagcgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg tatggtgcgc actacgaaga tgtgggtggc 1140
gacggccaga cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accctgttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggtt accgatgata acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag              1488
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<210> 1042
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1042

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Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Glu
1               5                  10                  15
Gly Gly Glu Leu Trp Pro Glu Leu Ala Glu Arg Ala Asp Gly Phe Asn
            20                  25                  30
Asp Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Thr Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
        115                 120                 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Phe Lys Cys Phe
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145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ala
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Asp
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Met Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Ala Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Tyr Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Gln Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Leu Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Asp Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1043
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1043

atgcgtaacc cgaccctgct gcaatgcttt cactggtact acccggaagg cggtaaactg 60
tggccggagc tggcggagcg tgcggacggt ttcaacgaca tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggactt caaatgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggttgcggt gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttgacaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtatgggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg tatggtgcgc actacgaaga tgtgggtggc 1140
gacggccaga cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accctgttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggtt accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag 1488

<210> 1044
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1044
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Glu
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Asp Gly Phe Asn
20 25 30
Asp Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
115 120 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140

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Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Phe Lys Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ala
                245                 250                 255
Val Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Asp
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Met Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Tyr Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Gln Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Leu Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1045
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1045
atgcgtaacc cgaccctgct gcaatgcttt cactggtact acccggaagg cggtaaactg 60
tggccggagc tggcggagcg tgcgtctggt ttcaacgaca tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggactt caaatgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggttgcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttgacaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtatgggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg tatggtgcgc actacgaaga tgtgggtggc 1140
gacggccaga cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accctgttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggtt accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag 1488

<210> 1046
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1046
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Glu
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Ser Gly Phe Asn
20 25 30
Asp Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
115 120 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro

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    130                 135                 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Phe Lys Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ala
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Asp
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Met Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Tyr Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Gln Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Leu Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1047
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1047
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggagcg tgcggacggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgac gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggactt taaatgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttgacaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accctgttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtgacg accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggagg ttatctag 1488

<210> 1048
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1048
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Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Asp Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
115 120 125

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Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Phe Lys Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Asp
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Leu Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Thr Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1049
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>

<223> Variant of alpha-amylase from Escherichia coli

<400> 1049
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggactt caaatgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggttgcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttgacaagc tgcagaccta cattgatcaa 840
gttgagggtt ataccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtatgggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg tatggtgcgc actacgaaga tgtgggtggc 1140
gacggccaga cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accctgttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggtt accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag 1488

<210> 1050
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1050
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Glu
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Asp Gly Phe Asn
20 25 30
Asp Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile

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        115                 120                 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Phe Lys Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ala
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Asp
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Tyr Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Met Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Tyr Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Gln Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Leu Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1051
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1051
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcattc caaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggactt caaatgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttgacaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtatgggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg tatggtgcgc actacgaaga tgtgggtggc 1140
gacggccaga cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accctgttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggtt accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag 1488

<210> 1052
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1052
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Glu
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Asp Gly Phe Asn
            20   25   30
Asp Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100   105   110

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Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
        115                 120                 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Phe Lys Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Asp
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Met Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Tyr Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Gln Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Leu Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1053
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1053
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggactt caaatgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag gtgttgcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttgacaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtatgggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg tatggtgcgc actacgaaga tgtgggtggc 1140
gacggccaga cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accctgttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggtt accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag 1488

<210> 1054
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1054
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Glu
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Asp Gly Phe Asn
            20   25   30
Asp Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys

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            100                 105                 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
        115                 120                 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Phe Lys Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Gly Val Ala
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Asp
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Met Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Tyr Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Gln Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Leu Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1055
<211> 1488
<212> DNA

<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1055
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tggccggagc tggcggagcg tgcggacggt ttcaacgata tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcgttc caaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggactt taaatgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttgacaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtatgggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg tatggtgcgc actacgaaga tgtgggtggc 1140
gacggccaga cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accctgttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggatg ttatctag 1488

<210> 1056
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1056
Met Lys Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Glu
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Asp Gly Phe Asn
20 25 30
Asp Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Val Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
85 90 95

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Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
        115                 120                 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Phe Lys Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Asp
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Met Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Tyr Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Gln Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Leu Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Asp Val Ile
                485                 490                 495
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<210> 1057
<211> 1488

<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1057
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggagcg tgcggacggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcgttc caaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgac gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggactt caaatgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttgacaagc tgcagaccta cattgatcaa 840
gttgatggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtatgggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcga gctacgaaga tgtgggtggc 1140
gacggccaga cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accctgttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggatg ttatctag 1488

<210> 1058
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1058
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Asp Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Val Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala

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                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Phe Lys Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Asp
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Asp Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Met Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala Ser Tyr Glu Asp Val Gly Gly Asp Gly Gln Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Leu Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Asp Val Ile
                485                 490                 495
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<210> 1059

<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1059
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tggccggagc tggcggagcg tgcggacggt ttcaacgaca tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggcacttac agccaattta tctgggactt caaatgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggttgcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttgacaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtatgggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg tatggtgcgc actacgaaga tgtgggtggc 1140
gacggccaga cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accctgttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggtt accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag 1488

<210> 1060
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1060
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Glu
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Asp Gly Phe Asn
20 25 30
Asp Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80

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Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
        115                 120                 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Ala Arg Ala Gly Thr Tyr Ser Gln Phe Ile Trp Asp Phe Lys Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ala
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Asp
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Met Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Tyr Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Gln Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Leu Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1061
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1061
atgcgtaacc cgaccctgct gcaatgcttt cactggtact acccggaagg cggtaagctg 60
tggccggagc tggcggagcg tgcggacggt ttcaacgaca tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggactt caaatgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggttgcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttgacaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtatgggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aagcgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg tatggtgcgc actacgaaga tgtgggtggc 1140
gacggccaga cctacccgat cgaaatgccg atcattgagc aactgcacga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accctgttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgaagaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcaaga gcgtgtggtt accgatgaga acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag 1488

<210> 1062
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1062
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Glu
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Asp Gly Phe Asn
            20   25   30
Asp Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys

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65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
        115                 120                 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Phe Lys Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ala
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Asp
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Met Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Ala Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Tyr Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Gln Thr
    370                 375                 380
Tyr Pro Ile Glu Met Pro Ile Ile Glu Gln Leu His Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Leu Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Glu Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1063
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1063
atgcgtaacc cgaccctgct gcaatgcttt cactggtact acccggaagg cggtaaactg 60
tggccggagc tggcggagcg tgcggacggt ttcaacgaca tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggactt caaatgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggttgcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttgacaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtatgggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg tatggtgcgc actacgaaga tgtgggtggc 1140
gacggccaga cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accctgttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggtt accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttctgtag 1488

<210> 1064
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1064
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Glu
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Asp Gly Phe Asn
20 25 30
Asp Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60

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Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
        115                 120                 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Phe Lys Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ala
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Asp
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Met Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Tyr Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Gln Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Leu Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Leu
                485                 490                 495
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<210> 1065
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1065
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tggccggagc tggcggagcg tgcggacggt ttcaacgaca tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggactt caaatgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggttgcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttgacaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtatgggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcgcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg tatggtgcgc actacgaaga tgtgggtggc 1140
gacggccaga cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accctgttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggtt accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag 1488

<210> 1066
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1066
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Glu
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Asp Gly Phe Asn
            20   25   30
Asp Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu

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    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
        115                 120                 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Phe Lys Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ala
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Asp
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Met Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Tyr Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Gln Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Leu Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
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485 490 495

<210> 1067
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1067
atgcgtaacc cgaccctgct gcaatgcttt cactggtact acccggaagg cggtaaactg 60
tggccggagc tggcggagcg tgcgggggt ttcaacgaca tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggactt caaatgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggttgcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttgacaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaaatttca cgaagcgagc 900
cgtatgggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg tatggtgcgc actacgaaga tgtgggtggc 1140
gacggccaga cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accctgttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggtt accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag 1488

<210> 1068
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1068
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Glu
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Gly Gly Phe Asn
20 25 30
Asp Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45

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Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
        115                 120                 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Phe Lys Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ala
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Asp
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Met Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Tyr Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Gln Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Leu Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
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Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
485 490 495

<210> 1069
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1069
atgcgtaacc cgaccctgct gcaatgcttt cactggtact acccggaagg cggtaaactg 60
tggccggagc tggcggagcg tgcggacggt ttcaacgaca tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggactt caaatgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggttgcgcc gaagcagctg 780
tttatcgtgg cggagtattg gagccacgaa gttgacaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtatgggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg tatggtgcgc actacgaaga tgtgggtggc 1140
gacggccaga cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accctgttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggtt accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag 1488

<210> 1070
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1070
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Glu
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Asp Gly Phe Asn
20 25 30
Asp Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala

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        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
        115                 120                 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Phe Lys Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ala
                245                 250                 255
Pro Lys Gln Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Asp
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Met Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Tyr Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Gln Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Leu Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
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465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1071
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1071
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggactt caaatgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggttgcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttgacaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtatgggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg tatggtgcgc actacgaaga tgtgggtggc 1140
gacggccaga cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accctgttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggtt accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag tttattag              1488
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<210> 1072
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1072
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Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Glu
1               5                   10                  15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Asp Gly Phe Asn
            20                  25                  30
```

```
Asp Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
        115                 120                 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Phe Lys Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ala
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Asp
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Met Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Tyr Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Gln Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Leu Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
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Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465 470 475 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Tyr
485 490 495

<210> 1073
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1073
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggaacg tgcggatggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta taagtgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattcgccaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgaggaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggacg ttatctag 1488

<210> 1074
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1074
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Asp Gly Phe Asn

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            20                  25                  30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
        115                 120                 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Lys Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Arg Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Glu Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
```

```
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Asp Val Ile
                485                 490                 495
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<210> 1075
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1075

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tggccggagc tggcggaacg tgcggatggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta taagtgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgaggaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag              1488
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<210> 1076
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1076

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Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1               5                   10                  15
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Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Asp Gly Phe Asn
            20                  25                  30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
        115                 120                 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Lys Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Glu Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
```

Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450   455   460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465   470   475   480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485   490   495

<210> 1077
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1077
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggaacg tgcggatggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta taaatgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgacgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggacg ttatctag   1488

<210> 1078
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1078
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp

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1               5                   10                  15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Asp Gly Phe Asn
            20                  25                  30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
        115                 120                 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Lys Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
```

```
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Asp Val Ile
                485                 490                 495
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<210> 1079
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1079
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta taagtgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattcgccaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactgcatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgacgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag              1488
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<210> 1080
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1080

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Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1               5                  10                  15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Arg Gly Phe Asn
            20                  25                  30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
        115                 120                 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Lys Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Arg Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu His Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
```

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Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1081
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1081
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tggccggagc tggcggagcg tgcggacggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta taaatgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaaa gcgtttcgcc aaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttgacaagc tgcagaccta cattgatcaa 840
gttgagggta gtaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcga gctacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcagtcaa accctgttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtgagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag              1488
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<210> 1082
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1082
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Asp Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100   105   110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
        115   120   125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130   135   140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Lys Cys Phe
145   150   155   160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165   170   175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180   185   190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195   200   205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210   215   220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225   230   235   240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Ser Val Ser
                245   250   255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Asp
            260   265   270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Ser Thr Met Leu Phe
        275   280   285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290   295   300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305   310   315   320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325   330   335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340   345   350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355   360   365
Asp Leu Phe Gly Ala Ser Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370   375   380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385   390   395   400
Ala Arg Gln Arg Phe Ala His Gly Ser Gln Thr Leu Phe Phe Asp His
                405   410   415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly

```
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Glu Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1083
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1083
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta taaatgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc aaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttgacaagc tgcagaccta cattgatcaa 840
gttgagggta gtaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcga gctacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcagtcaa accctgttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaca acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag              1488
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<210> 1084
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1084
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Asp Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100   105   110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
        115   120   125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130   135   140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Lys Cys Phe
145   150   155   160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165   170   175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180   185   190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195   200   205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210   215   220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225   230   235   240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245   250   255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Asp
            260   265   270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Ser Thr Met Leu Phe
        275   280   285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290   295   300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305   310   315   320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325   330   335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340   345   350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355   360   365
Asp Leu Phe Gly Ala Ser Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370   375   380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385   390   395   400
Ala Arg Gln Arg Phe Ala His Gly Ser Gln Thr Leu Phe Phe Asp His
                405   410   415

```
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Asp Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1085
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1085
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atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggagcg tgcggacggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta taaatgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcggg taagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttgacaagc tgcagaccta cattgatcaa 840
gttgagggta gtaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgttccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcga gctacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcagtcaa accctgttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtgagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag              1488
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<210> 1086
<211> 495
<212> PRT
<213> Artificial Sequence

<220>

<223> Variant of alpha-amylase from Escherichia coli

<400> 1086

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Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1               5                  10                  15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Asp Gly Phe Asn
            20                  25                  30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Lys Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Gly Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Asp
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Ser Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala Ser Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Ser Gln Thr Leu Phe Phe Asp His
```

```
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Glu Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1087
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1087
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccgttac agccaattta tctgggacta taaatgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaaa gcgtttcgcc aaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttgacaagc tgcagaccta cattgatcaa 840
gttgagggta gtaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc attacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcagtcaa accctgttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttgagtag              1488
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<210> 1088
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1088
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Asp Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100   105   110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
        115   120   125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130   135   140
Ala Arg Ala Gly Arg Tyr Ser Gln Phe Ile Trp Asp Tyr Lys Cys Phe
145   150   155   160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165   170   175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180   185   190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195   200   205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210   215   220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225   230   235   240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Ser Val Ser
                245   250   255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Asp
            260   265   270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Ser Thr Met Leu Phe
        275   280   285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290   295   300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305   310   315   320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325   330   335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340   345   350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355   360   365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370   375   380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385   390   395   400

Ala Arg Gln Arg Phe Ala His Gly Ser Gln Thr Leu Phe Phe Asp His
405 410 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
420 425 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
435 440 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
450 455 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465 470 475 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Glu
485 490 495

<210> 1089
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1089
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccgttac agccaattta tctgggacta taaatgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcggg taagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttgacaagc tgcagaccta cattgatcaa 840
gttgagggta gtaccatgct gttcgacgcg ccgttgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc attacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcagtcaa accctgttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtgagga gcgtgtggta accgatgaca acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag 1488

<210> 1090
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1090
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Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Asp Gly Phe Asn
            20                  25                  30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Ala Arg Ala Gly Arg Tyr Ser Gln Phe Ile Trp Asp Tyr Lys Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Gly Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Asp
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Ser Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
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385 390 395 400
Ala Arg Gln Arg Phe Ala His Gly Ser Gln Thr Leu Phe Phe Asp His
405 410 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
420 425 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
435 440 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
450 455 460
Arg Glu Glu Arg Val Val Thr Asp Asp Asn Gly Glu Ala Thr Phe Phe
465 470 475 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
485 490 495

<210> 1091
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1091
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta taaatgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaaa gcgtttcgcc aaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttgacaagc tgcagaccta cattgatcaa 840
gttgagggta gtaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgttccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcagtcaa accctgttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtgagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttgagtag 1488

<210> 1092
<211> 495
<212> PRT

<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1092
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Asp Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100   105   110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
        115   120   125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130   135   140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Lys Cys Phe
145   150   155   160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165   170   175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180   185   190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195   200   205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210   215   220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225   230   235   240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Ser Val Ser
                245   250   255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Asp
            260   265   270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Ser Thr Met Leu Phe
        275   280   285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290   295   300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305   310   315   320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325   330   335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340   345   350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355   360   365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370   375   380

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Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Ser Gln Thr Leu Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Glu Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Glu
                485                 490                 495
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<210> 1093
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1093
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta taaatgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaaa gcgtttcggg taagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttgacaagc tgcagaccta cattgatcaa 840
gttgagggta gtaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc attacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcagtcaa accctgttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaca acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag              1488
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<210> 1094
<211> 495

<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1094
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1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Asp Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
115 120 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Lys Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Ser Val Ser
245 250 255
Gly Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Asp
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Ser Thr Met Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
325 330 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
340 345 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
355 360 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr

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    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Ser Gln Thr Leu Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Asp Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1095
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1095
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta taagtgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattcgccaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgaggaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggacg ttatctag              1488
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<210> 1096

<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1096
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Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Asp Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100   105   110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
        115   120   125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130   135   140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Lys Cys Phe
145   150   155   160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165   170   175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180   185   190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195   200   205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210   215   220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225   230   235   240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245   250   255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260   265   270
Lys Leu Gln Thr Tyr Ile Arg Gln Val Glu Gly Lys Thr Met Leu Phe
        275   280   285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290   295   300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305   310   315   320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325   330   335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340   345   350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355   360   365

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Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Glu Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Asp Val Ile
                485                 490                 495
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<210> 1097
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1097
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta taagtgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattcgccaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgacgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggacg ttatctag              1488
```

<210> 1098
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1098
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
                85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100 105 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
        115 120 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Lys Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165 170 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260 265 270
Lys Leu Gln Thr Tyr Ile Arg Gln Val Glu Gly Lys Thr Met Leu Phe
        275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325 330 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340 345 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro

```
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Asp Val Ile
                485                 490                 495
```

<210> 1099
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1099
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta taagtgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactgcatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgacgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag              1488
```

<210> 1100
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1100
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
115 120 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Lys Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
325 330 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
340 345 350

```
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu His Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
```

<210> 1101
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1101

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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta taagtgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttgacaagc tgcagaccta cattcgccaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgaggaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag              1488
```

<210> 1102
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1102
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
115 120 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Lys Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Asp
260 265 270
Lys Leu Gln Thr Tyr Ile Arg Gln Val Glu Gly Lys Thr Met Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
325 330 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr

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            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Glu Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1103
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1103

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atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
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tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag 1488

<210> 1104
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1104
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
115 120 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
325 330 335

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Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1105
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1105

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tggccggagc tggcggcacg tgcggatggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattcgccaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgagatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgaggaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
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tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag 1488

<210> 1106
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1106
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Asp Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
115 120 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Arg Gln Val Glu Gly Lys Thr Met Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu

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                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Glu Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Glu Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1107
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1107
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tggccggagc tggcggcacg tgcggatggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgacgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
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gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag 1488

<210> 1108
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1108
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Asp Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
115 120 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320

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Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1109
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1109
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tggccggagc tggcggaacg tgcggatggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattcgccaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc gactgcatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accgatttct ttgaccaccc gaactgcatc 1260
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gcgttcagcc gtagcggtac cgaggaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggacg ttatctag 1488

<210> 1110
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1110
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Asp Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
115 120 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Arg Gln Val Glu Gly Lys Thr Met Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp

305 310 315 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
325 330 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
340 345 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
355 360 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
370 375 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Arg Leu His Glu Leu Ile Leu
385 390 395 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
405 410 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Glu Glu Phe Pro Gly
420 425 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
435 440 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
450 455 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465 470 475 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Asp Val Ile
485 490 495

<210> 1111
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1111
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggaacg tgcggatggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgagatgccg atcattgagc aactggatga actgattctg 1200

gcgcgtcagc gtttcgcgca cggcgttcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgaggaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggacg ttatctag 1488

<210> 1112
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1112
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Asp Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
115 120 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
290 295 300

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Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Glu Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Glu Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Asp Val Ile
                485                 490                 495
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<210> 1113
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1113
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tggccggagc tggcggaacg tgcggatggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
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gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgaggaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag 1488

<210> 1114
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1114
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Asp Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
115 120 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg

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    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Glu Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1115
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1115
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tggccggagc tggcggaacg tgcggatggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttgacaagc tgcagaccta cattcgccaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
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ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgagatgccg atcattgagc aactgcatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgaggaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag 1488

<210> 1116
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1116
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Asp Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
115 120 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Asp
260 265 270
Lys Leu Gln Thr Tyr Ile Arg Gln Val Glu Gly Lys Thr Met Leu Phe
275 280 285

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Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Glu Met Pro Ile Ile Glu Gln Leu His Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Glu Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1117
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1117
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta taaatgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc aaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttgacaagc tgcagaccta cattgatcaa 840
gttgagggta gtaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
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gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc attacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcagtcaa accctgttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaca acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag 1488

<210> 1118
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1118
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Asp Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
115 120 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Lys Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Asp
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Ser Thr Met Leu Phe

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        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Ser Gln Thr Leu Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Asp Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1119
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1119

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tggccggagc tggcggagcg tgcggacggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccgttac agccaattta tctgggacta taaatgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcggg taagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttgacaagc tgcagaccta cattgatcaa 840
gttgagggta gtaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
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ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc attacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcagtcaa accctgttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtgagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag 1488

<210> 1120
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1120
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Asp Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
115 120 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Arg Tyr Ser Gln Phe Ile Trp Asp Tyr Lys Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Gly Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Asp
260 265 270

Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Ser Thr Met Leu Phe
        275   280   285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290   295   300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305   310   315   320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325   330   335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340   345   350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355   360   365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370   375   380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385   390   395   400
Ala Arg Gln Arg Phe Ala His Gly Ser Gln Thr Leu Phe Phe Asp His
                405   410   415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420   425   430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435   440   445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450   455   460
Arg Glu Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465   470   475   480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485   490   495

<210> 1121
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1121
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900

cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag 1488

<210> 1122
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1122
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
115 120 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly

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            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1123
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1123
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840

gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag 1488

<210> 1124
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1124
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
115 120 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255

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Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1125
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1125
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacccggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
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tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag 1488

<210> 1126
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1126
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu Ala Ile Arg Val Gln Arg Val Asn Pro Asp Asp Arg Thr Gln Ile
115 120 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser

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                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1127
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1127
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacatttg gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
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ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag 1488

<210> 1128
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1128
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
115 120 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Trp Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240

Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
325 330 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
340 345 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
355 360 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
370 375 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385 390 395 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
405 410 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
420 425 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
435 440 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
450 455 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465 470 475 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
485 490 495

<210> 1129
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1129
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660

cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag 1488

<210> 1130
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1130
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
115 120 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile

225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
325 330 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
340 345 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
355 360 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
370 375 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385 390 395 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
405 410 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
420 425 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
435 440 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
450 455 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465 470 475 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
485 490 495

<210> 1131
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1131
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aaccgtgacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600

atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag 1488

<210> 1132
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1132
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu Ala Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Ile
115 120 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220

Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
325 330 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
340 345 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
355 360 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
370 375 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385 390 395 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
405 410 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
420 425 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
435 440 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
450 455 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465 470 475 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
485 490 495

<210> 1133
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1133
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540

tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggtt tgcgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag 1488

<210> 1134
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1134
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
115 120 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met

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    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Leu
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1135
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1135
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tataccttтc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
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agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccgagg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag 1488

<210> 1136
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1136
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
115 120 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Glu Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205

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Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1137
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1137
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggaccaag 420

tataccttтc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag 1488

<210> 1138
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1138
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
115 120 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Lys Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg

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        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1139
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1139
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360

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aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatac gctgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag              1488
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<210> 1140
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1140

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Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1               5                  10                  15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20                  25                  30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
        115                 120                 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
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Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Thr Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1141
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1141
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300

gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggaca ggcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag 1488

<210> 1142
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1142
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Arg Arg Thr Gln Ile
115 120 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp

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            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1143
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1143
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240

gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagcaggaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag 1488

<210> 1144
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1144
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Gln
100 105 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
115 120 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175

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Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1145
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1145
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180

ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca atgggatgag gaaatcattg agtgcgaagg ttggacccgt 420
tataccttтc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag 1488

<210> 1146
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1146
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Trp
115 120 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys

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                165                 170                 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1147
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1147
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120

ctgccgccgg cgtataaagg tgcgagcggt cgttacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag 1488

<210> 1148
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1148
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Arg Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
115 120 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160

Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
325 330 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
340 345 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
355 360 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
370 375 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385 390 395 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
405 410 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
420 425 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
435 440 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
450 455 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465 470 475 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
485 490 495

<210> 1149
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1149
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60

tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcaggctta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag 1488

<210> 1150
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1150
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
115 120 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe

145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
260 265 270
Lys Leu Gln Ala Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
325 330 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
340 345 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
355 360 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
370 375 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385 390 395 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
405 410 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
420 425 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
435 440 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
450 455 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465 470 475 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
485 490 495

<210> 1151
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1151

atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gctaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag 1488

<210> 1152
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1152
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Ala Lys
100 105 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
115 120 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140

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Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1153
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1153
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca catggcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag 1488

<210> 1154
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1154
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
115 120 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro

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    130                 135                 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Met Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1155
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1155
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattag gatggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag 1488

<210> 1156
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1156
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20 25 30
Glu Ile Gly Ile Arg Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
                85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100 105 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
        115 120 125

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Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1157
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>

<223> Variant of alpha-amylase from Escherichia coli

<400> 1157
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccgtgg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag 1488

<210> 1158
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1158
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile

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        115                 120                 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Val Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1159
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1159
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatttg 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag 1488

<210> 1160
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1160
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110

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Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
        115                 120                 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Leu Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1161
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1161
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaaa ggggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag 1488

<210> 1162
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1162
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys

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            100                 105                 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
        115                 120                 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Arg Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1163
<211> 1488
<212> DNA

<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1163
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaagta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag 1488

<210> 1164
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1164
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
85 90 95

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Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
        115                 120                 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Lys Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1165
<211> 1488

<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1165
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac attgatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag 1488

<210> 1166
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1166
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala

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                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
        115                 120                 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Ile Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1167

<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1167
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaag agggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag 1488

<210> 1168
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1168
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80

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Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
        115                 120                 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Glu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1169
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1169
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca caaggcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag 1488

<210> 1170
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1170
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys

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65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu Ala Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
        115                 120                 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Lys Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1171
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1171
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aacccagacg atcgtaccca aatcgatgaa gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga aaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggtg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgttccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggctcgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag 1488

<210> 1172
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1172
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60

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Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Pro Asp Asp Arg Thr Gln Ile
        115                 120                 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Ser Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1173
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1173
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca aatcgatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga aaacccggac attgatggca tcttcaagat tgtgaacgac 540
tataccggtg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggctcgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag 1488

<210> 1174
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1174
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu

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    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Ile
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Ile Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Ser Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
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485 490 495

<210> 1175
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1175
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgaa gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggtg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgttccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag 1488

<210> 1176
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1176
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45

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Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
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Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
485 490 495

<210> 1177
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1177
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgaa gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggtg agggctggaa cgatcaggtt gacgatgaac gcggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgttccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggctcgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag 1488

<210> 1178
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1178
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala

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        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Arg Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Ser Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
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465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1179
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1179
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagct gcaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttataaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaaa tgaattttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
gtaaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag              1488
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<210> 1180
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1180
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Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1               5                   10                  15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20                  25                  30
```

```
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
        115                 120                 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Leu Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Asn Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
```

Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465 470 475 480
Val Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
485 490 495

<210> 1181
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1181
atgcgcaacc cgaccctgct gcaatgtttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg gtggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttataaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgagtcaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc agctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
gtaaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag 1488

<210> 1182
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1182
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn

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            20                  25                  30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
        115                 120                 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Ser Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
```

```
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Val Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
```

<210> 1183
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1183

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atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggtg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag              1488
```

<210> 1184
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1184

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Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1               5                   10                  15
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Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20                  25                  30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
        115                 120                 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
```

```
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
```

<210> 1185
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1185
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atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggctcgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag              1488
```

<210> 1186
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1186
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Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
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1               5                   10                  15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20                  25                  30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
        115                 120                 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Ser Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
```

```
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
```

<210> 1187
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1187
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atgcgcaacc cgaccctgct gcaatgtttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttataaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttacg 1440
gtaaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag              1488
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<210> 1188
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1188

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Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1               5                  10                  15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20                  25                  30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
        115                 120                 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
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Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
435 440 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
450 455 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Thr
465 470 475 480
Val Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
485 490 495

<210> 1189
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1189
atgcgcaacc cgaccctgct gcaatgtttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagc gtggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttataaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaaa tgaattttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag 1488

<210> 1190
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1190
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100   105   110
Glu His Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
        115   120   125
Asp Glu Glu Ile Ile Glu Cys Glu Ala Trp Thr Arg Tyr Thr Phe Pro
    130   135   140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145   150   155   160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165   170   175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180   185   190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195   200   205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210   215   220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225   230   235   240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245   250   255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260   265   270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275   280   285
Asp Ala Pro Leu Gln Met Asn Phe His Glu Ala Ser Arg Gln Gly Arg
    290   295   300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305   310   315   320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325   330   335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340   345   350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355   360   365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370   375   380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385   390   395   400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405   410   415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly

```
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1191
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1191
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagc gtggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagct gcaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttataaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaaa tgaaatttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccc atcattgagg agctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttccg 1440
gtaaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag              1488
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<210> 1192
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1192
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100   105   110
Glu His Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
        115   120   125
Asp Glu Glu Ile Ile Glu Cys Glu Ala Trp Thr Arg Tyr Thr Phe Pro
    130   135   140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145   150   155   160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165   170   175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180   185   190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195   200   205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210   215   220
Glu Gln Leu Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225   230   235   240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245   250   255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260   265   270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275   280   285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290   295   300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305   310   315   320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325   330   335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340   345   350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355   360   365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370   375   380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Glu Leu Asp Glu Leu Ile Leu
385   390   395   400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405   410   415

```
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Pro
465                 470                 475                 480
Val Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1193
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1193
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgttccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
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<210> 1194
<211> 495
<212> PRT
<213> Artificial Sequence

<220>

<223> Variant of alpha-amylase from Escherichia coli

<400> 1194

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Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
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Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20                  25                  30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
        115                 120                 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
```

```
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1195
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1195
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg gtggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac tcaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaaa tgaattttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg agctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag              1488
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<210> 1196
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1196
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100   105   110
Glu His Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
        115   120   125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130   135   140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145   150   155   160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165   170   175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180   185   190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195   200   205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210   215   220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225   230   235   240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245   250   255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260   265   270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275   280   285
Asp Ala Pro Leu Gln Met Asn Phe His Glu Ala Ser Arg Gln Gly Arg
    290   295   300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305   310   315   320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325   330   335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340   345   350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355   360   365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370   375   380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Glu Leu Asp Glu Leu Ile Leu
385   390   395   400

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Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1197
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1197
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag              1488
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<210> 1198
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1198
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100   105   110
Glu His Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
        115   120   125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130   135   140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145   150   155   160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165   170   175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180   185   190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195   200   205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210   215   220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225   230   235   240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245   250   255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260   265   270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275   280   285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290   295   300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305   310   315   320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325   330   335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340   345   350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355   360   365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370   375   380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu

385 390 395 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
405 410 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
420 425 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
435 440 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
450 455 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465 470 475 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
485 490 495

<210> 1199
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1199
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aacccagacg atcgtaccca aatcgatgaa gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgttccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag 1488

<210> 1200
<211> 495
<212> PRT

<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1200
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100   105   110
Glu His Ile Arg Val Gln Arg Val Asn Pro Asp Asp Arg Thr Gln Ile
        115   120   125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130   135   140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145   150   155   160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165   170   175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180   185   190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195   200   205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210   215   220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225   230   235   240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245   250   255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260   265   270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275   280   285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290   295   300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305   310   315   320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325   330   335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340   345   350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355   360   365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370   375   380

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Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1201
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1201
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aacccagacg atcgtaccca aatcgatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac gcggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag              1488
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<210> 1202
<211> 495

<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1202
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Pro Asp Asp Arg Thr Gln Ile
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Arg Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
325 330 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
340 345 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
355 360 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr

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    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1203
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1203
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aacccagacg atcgtaccca aatcgatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac gcggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag              1488
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<210> 1204

<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1204
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100   105   110
Glu His Ile Arg Val Gln Arg Val Asn Pro Asp Asp Arg Thr Gln Ile
        115   120   125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130   135   140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145   150   155   160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165   170   175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180   185   190
Glu Arg Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195   200   205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210   215   220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225   230   235   240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245   250   255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260   265   270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275   280   285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290   295   300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305   310   315   320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325   330   335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340   345   350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355   360   365

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Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1205
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1205
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atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca aatcgatgaa gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga aaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggtg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgttccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag              1488
```

<210> 1206
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1206
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Ile
        115 120 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165 170 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325 330 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340 345 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro

```
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
```

<210> 1207
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1207
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca aatcgatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacatttg gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac gcggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgttccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggctcgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag              1488
```

<210> 1208
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1208
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Ile
        115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Trp Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180 185 190
Glu Arg Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325 330 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340 345 350

```
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Ser Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
```

<210> 1209
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1209

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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca aatcgatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga aaacccggac attgatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgttccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag              1488
```

<210> 1210
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1210
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Ile
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Ile Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
325 330 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr

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            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1211
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1211

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atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca aatcgatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga aaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggtg agggctggaa cgatcaggtt gacgatgaac gcggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgttccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
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tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag 1488

<210> 1212
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1212
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Ile
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Arg Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
325 330 335

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Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1213
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1213

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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca aatcgatgaa gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacatttg gaacccggac attgatggca tcttcaagat tgtgaacgac 540
tataccggtg agggctggaa cgatcaggtt gacgatgaac gcggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgttccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
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tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag 1488

<210> 1214
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1214
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Ile
115 120 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Trp Asn Pro Asp Ile Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Arg Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu

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                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1215
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1215
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca aatcgatgaa gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacatttg gaacccggac attgatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac gcggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
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gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag 1488

<210> 1216
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1216
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Ile
115 120 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Trp Asn Pro Asp Ile Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Arg Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320

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Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1217
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1217
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga aaacccggac attgatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac gcggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgttccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggctcgcaa accgatttct ttgaccaccc gaactgcatc 1260
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gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag 1488

<210> 1218
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1218
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Ile
115 120 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Ile Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Arg Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp

305 310 315 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
325 330 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
340 345 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
355 360 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
370 375 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385 390 395 400
Ala Arg Gln Arg Phe Ala His Gly Ser Gln Thr Asp Phe Phe Asp His
405 410 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
420 425 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
435 440 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
450 455 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465 470 475 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
485 490 495

<210> 1219
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1219
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacatttg gaacccggac attgatggca tcttcaagat tgtgaacgac 540
tataccggtg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgttccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200

gcgcgtcagc gtttcgcgca cggctcgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag 1488

<210> 1220
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1220
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Trp Asn Pro Asp Ile Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
290 295 300

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Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Ser Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1221
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1221
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga aaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggtg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
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gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag 1488

<210> 1222
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1222
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg

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    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1223
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1223
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
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ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag 1488

<210> 1224
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1224
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
275 280 285

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Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1225
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1225
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggtg agggctggaa cgatcaggtt gacgatgaac gcggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgttccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
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gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag 1488

<210> 1226
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1226
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Arg Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe

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        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1227
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1227
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgaa gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga aaacccggac attgatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac gcggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
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ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag 1488

<210> 1228
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1228
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Ile Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Arg Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
260 265 270

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Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1229
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1229
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgaa gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
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cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgttccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggctcgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag 1488

<210> 1230
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1230
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly

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            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Ser Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1231
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1231
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aacgcagacg atcgtaccca aatcgatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga aaacccggac attgatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
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gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggctcgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag 1488

<210> 1232
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1232
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Ile Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255

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Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Ser Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1233
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1233
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacatttg gaacccggac attgatggca tcttcaagat tgtgaacgac 540
tataccggtg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
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tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgttccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag 1488

<210> 1234
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1234
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
115 120 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Trp Asn Pro Asp Ile Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser

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                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1235
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1235
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacatttg gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggtg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
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ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag 1488

<210> 1236
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1236
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
115 120 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Trp Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240

Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
325 330 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
340 345 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
355 360 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
370 375 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385 390 395 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
405 410 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
420 425 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
435 440 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
450 455 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465 470 475 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
485 490 495

<210> 1237
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1237
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacatttg gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac gcggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660

cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag 1488

<210> 1238
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1238
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
115 120 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Trp Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Arg Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile

225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
325 330 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
340 345 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
355 360 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
370 375 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385 390 395 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
405 410 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
420 425 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
435 440 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
450 455 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465 470 475 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
485 490 495

<210> 1239
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1239
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600

atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag 1488

<210> 1240
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1240
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
115 120 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220

Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
325 330 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
340 345 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
355 360 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
370 375 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385 390 395 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
405 410 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
420 425 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
435 440 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
450 455 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465 470 475 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
485 490 495

<210> 1241
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1241
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540

tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgttccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag 1488

<210> 1242
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1242
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
115 120 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met

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    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1243
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1243
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aacgcagacg atcgtaccca aatcgatgaa gaaatcattg agtgcgaagg ttggacccgt 420
tataccttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480

agcggtatcg atcacattga aaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggctcgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag 1488

<210> 1244
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1244
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
115 120 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205

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Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Ser Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1245
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1245
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420

tataccttтc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac gcggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag 1488

<210> 1246
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1246
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
115 120 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Arg Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg

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        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1247
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1247
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360

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aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga aaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggtg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgttccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggctcgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag              1488
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<210> 1248
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1248

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Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1               5                  10                  15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20                  25                  30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
        115                 120                 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
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Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Ser Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1249
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1249
atgcgcaacc cgaccctgct gcaatgtttt cactggtact acccggatgg cggtaaactg 60
tggccggagg tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300

gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag 1488

<210> 1250
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1250
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Val Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
115 120 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp

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            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1251
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1251
atgcgcaacc cgaccctgct gcaatgtttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240

gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg agctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag 1488

<210> 1252
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1252
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
115 120 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175

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Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Glu Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1253
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1253
atgcgcaacc cgaccctgct gcaatgtttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180

ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggcg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagct gcaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaaa tgaaatttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgttcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag 1488

<210> 1254
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1254
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Ile
115 120 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys

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                165                 170                 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Leu Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1255
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1255
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120

ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag 1488

<210> 1256
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1256
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160

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Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1257
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1257
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgaga atctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag 1488

<210> 1258
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1258
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe

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145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Asn Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1259
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1259

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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagt cgctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag 1488

<210> 1260
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1260
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140

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Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Ser Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1261
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1261
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgtgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggggcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggttgcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtatgggtc gtgactatga tatgacgcaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcacacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaga cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgtaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag 1488

<210> 1262
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1262
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Glu
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Asp Gly Phe Asn
20 25 30
Asp Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro

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    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ala
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Met Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1263
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1263
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcggctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag 1488

<210> 1264
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1264
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115 120 125

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Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Arg Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1265
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>

<223> Variant of alpha-amylase from Escherichia coli

<400> 1265
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgtgacg atcgtaccca aattgatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggggcgtgc gggccagtac agccaattta tctgggacta tcgttgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggttgcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggtaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcagggtc gtgactatga tatgtcgcaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcacacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggccaga cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgtaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag 1488

<210> 1266
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1266
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Glu
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Asp Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Ile

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        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ala
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Ser Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Gln Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1267
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1267
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tggccggagc tggcggagcg tgcggatggt ttcaacgaaa tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca atgggatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggggcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggtg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggttgcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttgataagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcagggtc gtgactatga tatgtcgcaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcacacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaga cctacccgat cgacatgccg atcattgagg aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgtaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag 1488

<210> 1268
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1268
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Asp Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110

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Glu His Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ala
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Asp
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Ser Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Glu Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1269
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1269
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggagcg tgcggatggt ttcaacgaaa tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgtgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggggcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggttgcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttgataagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtatgggtc gtgactatga tatgtcgcaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaga cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
gtgaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag 1488

<210> 1270
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1270
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Asp Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys

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            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ala
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Asp
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Met Gly Arg
    290                 295                 300
Asp Tyr Asp Met Ser Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Val Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1271
<211> 1488
<212> DNA

<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1271
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgt 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag 1488

<210> 1272
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1272
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95

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Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1273
<211> 1488

<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1273
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgtgacg atcgtaccca atgggatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggggcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggtaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtatgggtc gtgactatga tatgtcgcaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcacacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgtaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag 1488

<210> 1274
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1274
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala

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                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Met Gly Arg
    290                 295                 300
Asp Tyr Asp Met Ser Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1275

<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1275
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggagcg tgcgcgtggt ttcaacgata tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgtgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggggcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggtaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgtcgcaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggccaga cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag 1488

<210> 1276
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1276
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Arg Gly Phe Asn
20 25 30
Asp Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80

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Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Ser Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Gln Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1277
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1277
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcgcg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgtgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggggcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggtaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtatgggtc gtgactatga tatgtcgcaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgtaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag 1488

<210> 1278
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1278
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys

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65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Met Gly Arg
    290                 295                 300
Asp Tyr Asp Met Ser Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1279
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1279
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggagcg tgcggatggt ttcaacgaaa tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgtgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggggcgtgc gggccagtac agccaattta tctgggactt tcgttgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggttgcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtatgggtc gtgactatga tatgacgcaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaga cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
gtgaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag 1488

<210> 1280
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1280
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Asp Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60

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Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Phe Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ala
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Met Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Val Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1281
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1281
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggagcg tgcggatggt ttcaacgata tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgtgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggggcgtgc gggccagtac agccaattta tctgggactt tcgttgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggtg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggttgcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcagggtc gtgactatga tatgtcgcaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcacacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggccaga cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag 1488

<210> 1282
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1282
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Asp Gly Phe Asn
20 25 30
Asp Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu

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    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Phe Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ala
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Ser Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Gln Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
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485 490 495

<210> 1283
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1283
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcgcg tgcggatggt ttcaacgaaa tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgtgacg atcgtaccca atgggatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggggcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggttgcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttgataagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcacacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg tacggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaga cctacccgat cgacatgccg atcattgagg aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgtaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag 1488

<210> 1284
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1284
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Asp Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45

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Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ala
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Asp
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Tyr Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Glu Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
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Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495


<210> 1285
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1285
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggagcg tgcgcgtggt ttcaacgaaa tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgtgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggggcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggtg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggttgcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcagggtc gtgactatga tatgtcgcaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcacacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggccaga cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgtaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag              1488


<210> 1286
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1286
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1               5                   10                  15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Arg Gly Phe Asn
            20                  25                  30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
```

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        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ala
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Ser Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Gln Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
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465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1287
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1287
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgtgacg atcgtaccca atgggatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggggcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggttgcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttgataagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcacacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg tacggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaga cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgtaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag              1488
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<210> 1288
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1288
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Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1               5                   10                  15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20                  25                  30
```

```
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ala
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Asp
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Tyr Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
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Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465 470 475 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
485 490 495

<210> 1289
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1289
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgtgacg atcgtaccca atgggatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggggcgtgc gggccagtac agccaattta tctgggacta taagtgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggtg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggtaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcacacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggccaga cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgtaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag 1488

<210> 1290
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1290
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn

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            20                  25                  30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Lys Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Gln Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
```

```
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1291
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1291

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atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggaggg cggtaaactg 60
tggccggagc tggcggagcg tgcgcgtggt ttcaacgaaa tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggggcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtatgggtc gtgactatga tatgacgcaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag              1488
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<210> 1292
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1292

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Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Glu
1               5                   10                  15
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Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Arg Gly Phe Asn
            20                  25                  30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Met Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
```

Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450   455   460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465   470   475   480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485   490   495

<210> 1293
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1293
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggaggg cggtaaactg 60
tggccggagc tggcggagcg tgcgcgtggt ttcaacgata tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgtgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggggcgtgc gggccagtac agccaattta tctgggacta taagtgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcagggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcacacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggccaga cctacccgat cgacatgccg atcattgagg aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgtaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag   1488

<210> 1294
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1294
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Glu

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1               5                   10                  15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Arg Gly Phe Asn
            20                  25                  30
Asp Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Lys Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Gln Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Glu Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
```

```
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1295
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1295
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atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggaggg cggtaaactg 60
tggccggagc tggcggagcg tgcgcgtggt ttcaacgata tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgtgacg atcgtaccca aattgatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggggcgtgc gggccagtac agccaattta tctgggacta tcgttgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggtaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtatgggtc gtgactatga tatgtcgcaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg tacggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaga cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag              1488
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<210> 1296
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1296

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Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Glu
1               5                  10                  15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Arg Gly Phe Asn
            20                  25                  30
Asp Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Ile
        115                 120                 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Met Gly Arg
    290                 295                 300
Asp Tyr Asp Met Ser Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Tyr Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
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Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
435 440 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
450 455 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465 470 475 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
485 490 495

<210> 1297
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1297
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggagcg tgcggatggt ttcaacgata tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgtgacg atcgtaccca atgggatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggggcgtgc gggccagtac agccaattta tctgggactt taagtgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggtg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggtaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcacacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag 1488

<210> 1298
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1298
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Asp Gly Phe Asn
            20   25   30
Asp Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100   105   110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115   120   125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130   135   140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Phe Lys Cys Phe
145   150   155   160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165   170   175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180   185   190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195   200   205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210   215   220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225   230   235   240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245   250   255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260   265   270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275   280   285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290   295   300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305   310   315   320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325   330   335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340   345   350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355   360   365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370   375   380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Glu Leu Asp Glu Leu Ile Leu
385   390   395   400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405   410   415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly

```
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1299
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1299
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tggccggagc tggcggcgcg tgcggatggt ttcaacgaaa tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggggcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccggtg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtatgggtc gtgactatga tatgtcgcaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaga cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accctgttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgtaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag              1488
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<210> 1300
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1300
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Asp Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100   105   110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115   120   125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130   135   140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145   150   155   160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165   170   175
Ile Val Asn Asp Tyr Thr Gly Glu Gly Trp Asn Asp Gln Val Asp Asp
            180   185   190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195   200   205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210   215   220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225   230   235   240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245   250   255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260   265   270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275   280   285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Met Gly Arg
    290   295   300
Asp Tyr Asp Met Ser Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305   310   315   320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325   330   335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340   345   350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355   360   365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370   375   380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385   390   395   400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Leu Phe Phe Asp His
                405   410   415

```
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1301
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1301
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atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcgcg tgcggatggt ttcaacgaaa tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggggcgtgc gggccagtac agccaattta tctgggacta taagtgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggtaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcagggtc gtgactatga tatgacgcaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggccaga cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgtaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag              1488
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<210> 1302
<211> 495
<212> PRT
<213> Artificial Sequence

<220>

<223> Variant of alpha-amylase from Escherichia coli

<400> 1302

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Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1               5                  10                  15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Asp Gly Phe Asn
            20                  25                  30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Lys Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Gln Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
```

```
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1303
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1303
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atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggagcg tgcgcgtggt ttcaacgata tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggggcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttgataagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtatgggtc gtgactatga tatgacgcaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaga cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
gtgaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag              1488
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<210> 1304
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1304
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Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1               5                  10                  15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Arg Gly Phe Asn
            20                  25                  30
Asp Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Asp
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Met Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
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Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Val Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1305
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1305
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atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcgcg tgcgcgtggt ttcaacgata tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aacgcggacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggggcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttgataagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcagggtc gtgactatga tatgtcgcaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcacacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaga cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accctgttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgtaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag              1488
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<210> 1306
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1306
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Asp Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100   105   110
Glu His Ile Arg Val Gln Arg Val Asn Ala Asp Asp Arg Thr Gln Trp
        115   120   125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130   135   140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145   150   155   160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165   170   175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180   185   190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195   200   205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210   215   220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225   230   235   240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245   250   255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Asp
            260   265   270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275   280   285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290   295   300
Asp Tyr Asp Met Ser Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305   310   315   320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325   330   335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340   345   350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355   360   365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370   375   380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu

385 390 395 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Leu Phe Phe Asp His
405 410 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
420 425 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
435 440 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
450 455 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465 470 475 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
485 490 495

<210> 1307
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1307
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagggg 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag 1488

<210> 1308
<211> 495
<212> PRT

<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1308
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100   105   110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115   120   125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130   135   140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145   150   155   160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165   170   175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180   185   190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195   200   205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210   215   220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225   230   235   240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245   250   255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260   265   270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275   280   285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290   295   300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305   310   315   320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325   330   335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340   345   350
Ala Leu Ile Leu Leu Arg Glu Gly Gly Val Pro Ser Val Phe Tyr Pro
        355   360   365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370   375   380

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Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1309
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1309
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atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcgcg tgcggatggt ttcaacgaaa tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgtgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggtaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcagggtc gtgactatga tatgtcgcaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcacacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaga cctacccgat cgacatgccg atcattgagg aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag              1488
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<210> 1310
<211> 495

<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1310
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Asp Gly Phe Asn
            20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290 295 300
Asp Tyr Asp Met Ser Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325 330 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340 345 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355 360 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr

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    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Glu Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1311
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1311
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atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatggcgcaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag              1488
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<210> 1312

<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1312
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100   105   110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115   120   125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130   135   140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145   150   155   160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165   170   175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180   185   190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195   200   205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210   215   220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225   230   235   240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245   250   255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260   265   270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275   280   285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290   295   300
Asp Tyr Asp Met Ala Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305   310   315   320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325   330   335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340   345   350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355   360   365

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Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1313
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1313
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tggccggagc tggcggagcg tgcgcgtggt ttcaacgata tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggggcgtgc gggccagtac agccaattta tctgggacta tcgttgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcagggtc gtgactatga tatgtcgcaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggccaga cctacccgat cgacatgccg atcattgagg aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag              1488
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<210> 1314
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1314
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Glu
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Arg Gly Phe Asn
            20   25   30
Asp Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100   105   110
Glu Ala Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115   120   125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130   135   140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145   150   155   160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165   170   175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180   185   190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195   200   205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210   215   220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225   230   235   240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245   250   255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260   265   270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275   280   285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290   295   300
Asp Tyr Asp Met Ser Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305   310   315   320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325   330   335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340   345   350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro

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        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Gln Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Glu Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1315
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1315
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaag cgatccgtgt gcagcgtgtt 360
aaccgtgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggggcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggtaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcagggtc gtgactatga tatgacgcaa atcttcaccg gcaccctggt ggaagcggac 960
ccgtttcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag              1488
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<210> 1316
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1316
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Glu Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100   105   110
Glu Ala Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115   120   125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130   135   140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145   150   155   160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165   170   175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180   185   190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195   200   205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210   215   220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225   230   235   240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245   250   255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260   265   270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275   280   285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290   295   300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305   310   315   320
Pro Phe His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325   330   335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340   345   350

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Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1317
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1317

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atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgtgacg atcgtaccca atgggatgag gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttgataagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaga cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
gtgaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag              1488
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<210> 1318
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1318
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Glu Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Asp
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
325 330 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr

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            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Val Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1319
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1319

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atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgatga accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
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tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag 1488

<210> 1320
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1320
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
325 330 335

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Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Met Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1321
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1321

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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gactcacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
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tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag 1488

<210> 1322
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1322
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Thr His Glu Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu

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                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1323
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1323
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
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gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacacgg gtagcgtgag cgtgtgggtg attgaggaag ttatctag 1488

<210> 1324
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1324
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320

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Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Thr Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1325
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1325
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atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cagtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
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gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag 1488

<210> 1326
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1326
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Ser Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp

305 310 315 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
325 330 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
340 345 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
355 360 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
370 375 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385 390 395 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
405 410 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
420 425 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
435 440 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
450 455 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465 470 475 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
485 490 495

<210> 1327
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1327
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg aagcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggtaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcagggtc gtgactatga tatgtcgcaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcacacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggccaga cctacccgat cgacatgccg atcattgagc aactggatga actgattctg 1200

gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag 1488

<210> 1328
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1328
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu Lys Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
290 295 300

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Asp Tyr Asp Met Ser Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Gln Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gln Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1329
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1329
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atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gagcaactgc tggcggcgat cgatgcgctg catcgcaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccagtgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaaaccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcgacg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
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gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttctgtag 1488

<210> 1330
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1330
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Glu Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg

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    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Asp Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Leu
                485                 490                 495
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<210> 1331
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1331
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gagcaactgc tggcggcgat cgatgcgctg catcgcaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccagtgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaaagatctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
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ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag 1488

<210> 1332
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1332
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Glu Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Asp Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
275 280 285

```
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1333
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1333
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgcaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaaaccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcgacg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
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gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag 1488

<210> 1334
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1334
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe

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        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Asp Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1335
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1335
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tggccggagc tggcggcacg tgcggcgggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
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ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag 1488

<210> 1336
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1336
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Ala Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
260 265 270

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Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1337
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1337
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atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
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cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaca acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag 1488

<210> 1338
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1338
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly

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            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Asp Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1339
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1339
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgcaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccagtgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaaagatctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
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gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcgacg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca atcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag 1488

<210> 1340
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1340
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255

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Pro Lys Asp Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Asp Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ser Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1341
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1341
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catgagaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccagtgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgga gcaaccgctg 780
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tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca atcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gactgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag 1488

<210> 1342
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1342
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Glu Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser

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                245                 250                 255
Glu Gln Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ser Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Thr Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1343
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1343
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atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
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ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaaaccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag 1488

<210> 1344
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1344
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240

Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
325 330 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
340 345 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
355 360 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
370 375 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385 390 395 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
405 410 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
420 425 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
435 440 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
450 455 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465 470 475 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
485 490 495

<210> 1345
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1345
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660

cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgtga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag 1488

<210> 1346
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1346
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile

225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
325 330 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
340 345 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
355 360 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
370 375 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385 390 395 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
405 410 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
420 425 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
435 440 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
450 455 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465 470 475 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
485 490 495

<210> 1347
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1347
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600

atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcagc tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag 1488

<210> 1348
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1348
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220

Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
275 280 285
Asp Ala Pro Leu Gln Leu Lys Phe His Glu Ala Ser Arg Gln Gly Arg
290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
325 330 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
340 345 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
355 360 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
370 375 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385 390 395 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
405 410 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
420 425 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
435 440 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
450 455 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465 470 475 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
485 490 495

<210> 1349
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1349
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540

tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaccagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag 1488

<210> 1350
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1350
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met

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    210                 215                 220
Asp Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1351
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1351
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tataccttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480

agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaaaccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gattgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag 1488

<210> 1352
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1352
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205

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Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Ile Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1353
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1353
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catgagaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420

tataccttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gcaaccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag 1488

<210> 1354
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1354
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Glu Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg

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        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Gln Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1355
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1355
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360

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aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat taccctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag              1488
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<210> 1356
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1356

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Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1               5                  10                  15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20                  25                  30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
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Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile Thr
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1357
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1357
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300

gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tataccttтc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaaacgac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag 1488

<210> 1358
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1358
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp

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            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Thr Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1359
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1359
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240

gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcgtctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1360
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1360
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175

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Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Arg Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1361
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1361
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180

ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tatcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag 1488

<210> 1362
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1362
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys

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                165                 170                 175
Ile Ile Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1363
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1363
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120

ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg gcattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcgtctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg ctggaggaag ttatctag 1488

<210> 1364
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1364
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Gly Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160

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Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Arg Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Leu Glu Glu Val Ile
                485                 490                 495
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<210> 1365
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1365
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60

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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg accgtaccca atgggatgat gaaattattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcgtctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag 1488

<210> 1366
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1366
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe

145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
325 330 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Arg Leu Ala Tyr
340 345 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
355 360 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
370 375 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385 390 395 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
405 410 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
420 425 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
435 440 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
450 455 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465 470 475 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
485 490 495

<210> 1367
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1367

atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg gcattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
aagcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcgtctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg aactggacga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgaaggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1368
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1368
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Gly Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140

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Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Lys Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Arg Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Glu Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Glu Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1369
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1369
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1370
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1370
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro

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    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1371
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1371
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattac catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgaca accgtaccca atgggatgat gaaattattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgat cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcgtctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg aactggacga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgaaggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg ctggaggaag ttatctag 1488

<210> 1372
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1372
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Thr Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asn Arg Thr Gln Trp
115 120 125

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Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Asp His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Arg Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Glu Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Glu Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Leu Glu Glu Val Ile
                485                 490                 495
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<210> 1373
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>

<223> Variant of alpha-amylase from Escherichia coli

<400> 1373
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgat cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcgtctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgaaggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag 1488

<210> 1374
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1374
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp

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        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Asp His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Arg Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Glu Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1375
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1375
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattac catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag 1488

<210> 1376
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1376
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Thr Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100   105   110

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Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1377
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1377
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattac catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gtcgccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgaaggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg ctggaggaag ttatctag 1488

<210> 1378
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1378
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Thr Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys

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            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Ser Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Glu Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Leu Glu Glu Val Ile
                485                 490                 495
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<210> 1379
<211> 1488
<212> DNA

<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1379
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcgtctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgaaggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1380
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1380
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85   90   95

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Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Arg Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Glu Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1381
<211> 1488

<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1381
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg gcattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg accgtaccga atgggatgat gaagttattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgat cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcgtctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1382
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1382
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Gly Ile Ala

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                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Glu Trp
        115                 120                 125
Asp Asp Glu Val Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Asp His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Arg Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1383

<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1383
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaaaccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca atcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg attgaggaag ttatctag 1488

<210> 1384
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1384
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80

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Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ser Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1385
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1385
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccagagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catagtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cggcgcgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgtcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcgtctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg ctggaggaag ttatctag 1488

<210> 1386
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1386
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Ile Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys

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65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Ala Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Arg Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Leu Glu Glu Val Ile
                485                 490                 495
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<210> 1387
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1387
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattac catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgat cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgaa gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
aagcaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcgtctg gcgtatgcgc tgattctgct gcgtgagaac 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg aactggacga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1388
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1388
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Thr Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60

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Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Asp His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Glu Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Lys Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Arg Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Glu Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1389
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1389
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca atcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tactctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1390
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1390
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu

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    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ser Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile Thr
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
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485 490 495

<210> 1391
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1391
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaata agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt ttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gagtccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1392
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1392
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45

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Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Lys Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Ser Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
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Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495


<210> 1393
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1393
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag              1488


<210> 1394
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1394
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1               5                   10                  15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20                  25                  30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
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        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
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465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1395
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1395
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag              1488
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<210> 1396
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1396
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Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1               5                   10                  15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20                  25                  30
```

```
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
```

Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465 470 475 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
485 490 495

<210> 1397
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1397
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca atcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1398
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1398
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn

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            20                  25                  30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ser Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
```

```
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1399
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1399

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atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
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gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag              1488
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<210> 1400
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1400

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Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1               5                   10                  15
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Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20                  25                  30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
```

```
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1401
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1401
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atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt ttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag              1488
```

<210> 1402
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1402
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Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
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1               5                   10                  15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20                  25                  30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
```

```
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
```

<210> 1403
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1403
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atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag              1488
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<210> 1404
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1404

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Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1               5                  10                  15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20                  25                  30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
```

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Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1405
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1405
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atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacacgga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag              1488
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<210> 1406
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1406
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100   105   110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115   120   125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130   135   140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145   150   155   160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165   170   175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180   185   190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195   200   205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210   215   220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225   230   235   240
Pro Ala Trp Phe Tyr Thr Glu Trp Ile Glu His Val Gln Glu Val Ser
                245   250   255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260   265   270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275   280   285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290   295   300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305   310   315   320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325   330   335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340   345   350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355   360   365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370   375   380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385   390   395   400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405   410   415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly

```
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1407
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1407
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gagtccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggtcg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag              1488
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<210> 1408
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1408
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100   105   110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115   120   125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130   135   140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145   150   155   160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165   170   175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180   185   190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195   200   205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210   215   220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225   230   235   240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245   250   255
Pro Ser Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260   265   270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275   280   285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290   295   300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305   310   315   320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325   330   335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340   345   350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355   360   365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370   375   380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385   390   395   400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405   410   415

```
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1409
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1409
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atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag              1488
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<210> 1410
<211> 495
<212> PRT
<213> Artificial Sequence

<220>

<223> Variant of alpha-amylase from Escherichia coli

<400> 1410
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Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
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Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20                  25                  30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
```

```
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1411
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1411
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atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tactctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag              1488
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<210> 1412
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1412
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Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
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Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20                  25                  30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
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Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
405 410 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
420 425 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile Thr
435 440 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
450 455 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465 470 475 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
485 490 495

<210> 1413
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1413
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
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gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1414
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1414
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Ile Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100   105   110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115   120   125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130   135   140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145   150   155   160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165   170   175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180   185   190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195   200   205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210   215   220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225   230   235   240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245   250   255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260   265   270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275   280   285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290   295   300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305   310   315   320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325   330   335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340   345   350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355   360   365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370   375   380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu

385 390 395 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
405 410 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
420 425 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
435 440 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
450 455 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465 470 475 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
485 490 495

<210> 1415
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1415
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tactctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1416
<211> 495
<212> PRT

<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1416
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Ile Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100   105   110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115   120   125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130   135   140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145   150   155   160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165   170   175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180   185   190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195   200   205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210   215   220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225   230   235   240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245   250   255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260   265   270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275   280   285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290   295   300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305   310   315   320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325   330   335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340   345   350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355   360   365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370   375   380

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Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile Thr
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1417
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1417
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
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gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag              1488
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<210> 1418
<211> 495

<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1418
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20 25 30
Glu Ile Gly Ile Asn Ile Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325 330 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340 345 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355 360 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr

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    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1419
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1419
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt ttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag              1488
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<210> 1420

<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1420
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Ile Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100   105   110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115   120   125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130   135   140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145   150   155   160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165   170   175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180   185   190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195   200   205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210   215   220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225   230   235   240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245   250   255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260   265   270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275   280   285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290   295   300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305   310   315   320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325   330   335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340   345   350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355   360   365

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Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1421
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1421

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atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa cattgtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gagtccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag              1488
```

<210> 1422
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1422
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Ile Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Ser Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
325 330 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
340 345 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro

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        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1423
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1423

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atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa cattgtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag              1488
```

<210> 1424
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1424
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20 25 30
Glu Ile Gly Ile Asn Ile Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325 330 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340 345 350

```
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1425
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1425

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atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa cattgtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tactctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag              1488
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<210> 1426
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1426
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Ile Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
325 330 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr

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            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile Thr
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1427
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1427

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atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa cattgtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tactctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
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tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1428
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1428
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Ile Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
325 330 335

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Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile Thr
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1429
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1429

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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa cattgtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaaacgac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca atcgctggag 1020
gcgccggttg aaccgtggtt caagcgtctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
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tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1430
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1430
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Ile Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Thr Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu

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                325                 330                 335
Gln Ser Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Arg Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1431
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1431
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaaacgac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
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gacgatggcg agaaaaccat tactctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1432
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1432
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Ile Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Thr Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320

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Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile Thr
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1433
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1433

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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa cattgtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaaacgac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gagtccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
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gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1434
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1434
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Ile Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Thr Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Ser Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp

305 310 315 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
325 330 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
340 345 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
355 360 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
370 375 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385 390 395 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
405 410 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
420 425 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
435 440 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
450 455 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465 470 475 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
485 490 495

<210> 1435
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1435
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaaacgac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gagtccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca atcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200

gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tactctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1436
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1436
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Ile Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Thr Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Ser Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
290 295 300

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Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ser Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile Thr
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1437
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1437

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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaaacgac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gagtccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcgtctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
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gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1438
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1438
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Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
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Glu Ile Gly Ile Asn Ile Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Thr Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Ser Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg

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    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Arg Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1439
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1439
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaaacgac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaat 1080
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ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1440
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1440
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1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Ile Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Thr Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
275 280 285

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Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1441
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1441
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaaacgac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca atcgctggag 1020
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gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaat 1080
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gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
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gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1442
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1442
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Ile Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Thr Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe

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        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ser Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1443
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1443

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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa cattgtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tatcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
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ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
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tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1444
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1444
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
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Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Ile Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Ile Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
260 265 270

Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275   280   285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290   295   300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305   310   315   320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325   330   335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340   345   350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355   360   365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370   375   380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385   390   395   400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405   410   415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420   425   430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile Thr
        435   440   445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450   455   460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465   470   475   480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485   490   495

<210> 1445
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1445
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
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tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900

cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcgtctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tactctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1446
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1446
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Ile Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Ile Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly

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            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Arg Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile Thr
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1447
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1447
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa cattgtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tatcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaaacgac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
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gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca atcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1448
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1448
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Ile Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Ile Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Thr Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255

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Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ser Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1449
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1449
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
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tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcgtctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1450
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1450
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser

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                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Arg Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1451
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1451
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaaacgac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
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ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1452
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1452
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Thr Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240

Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
325 330 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
340 345 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
355 360 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
370 375 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385 390 395 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
405 410 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
420 425 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
435 440 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
450 455 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465 470 475 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
485 490 495

<210> 1453
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1453
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660

cgttgggtta tggaaacgac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1454
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1454
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Thr Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile

225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
325 330 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
340 345 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
355 360 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
370 375 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385 390 395 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
405 410 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
420 425 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
435 440 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
450 455 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465 470 475 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
485 490 495

<210> 1455
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1455
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600

atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaaacgac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt ttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcgtctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tactctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1456
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1456
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220

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Glu Thr Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Arg Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile Thr
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1457
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1457
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540

tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaaacgac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gagtccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tactctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1458
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1458
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met

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    210                 215                 220
Glu Thr Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Ser Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile Thr
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1459
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1459
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tataccttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480

agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaaacgac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gagtccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcgtctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1460
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1460
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205

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Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Thr Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Ser Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Arg Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1461
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1461
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420

tataccttтc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtgaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaaacgac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1462
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1462
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg

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        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Thr Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1463
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1463
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360

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aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaaacgac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tactctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag              1488
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<210> 1464
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1464

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Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1               5                  10                  15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20                  25                  30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
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Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Thr Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile Thr
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1465
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1465
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300

gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tataccttтc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaaacgac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcgtctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1466
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1466
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp

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            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Thr Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Arg Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1467
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1467
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240

gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tatcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1468
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1468
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175

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Ile Ile Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1469
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1469
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180

ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tatcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1470
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1470
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys

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                165                 170                 175
Ile Ile Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1471
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1471
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120

ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tatcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1472
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1472
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160

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Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Ile Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1473
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1473
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60

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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tatcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tactctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag              1488
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<210> 1474
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1474

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Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1               5                  10                  15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20                  25                  30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
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145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Ile Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile Thr
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1475
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1475

atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tatcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccatgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca atcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1476
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1476
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140

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Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Ile Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Met Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ser Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1477
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1477
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tatcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacagac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gagtccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
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gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1478
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1478
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro

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    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Ile Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Ser Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1479
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1479
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tatcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1480
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1480
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125

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Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Ile Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1481
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>

<223> Variant of alpha-amylase from Escherichia coli

<400> 1481
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tatcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca atcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tactctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1482
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1482
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp

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        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Ile Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ser Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile Thr
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1483
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1483
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tatcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca atcgctggag 1020
gcgccggttg aaccgtggtt caagcgtctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1484
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1484
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110

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Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Ile Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ser Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Arg Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1485
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1485
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tatcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaaacgac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gtcgccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccga atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca atcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1486
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1486
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys

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            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Ile Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Thr Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Ser Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Arg Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ser Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1487
<211> 1488
<212> DNA

<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1487
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tatcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaaacgac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttacaaaga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
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cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca atcgctggag 1020
gcgccggttg aaccgtggtt caagccgctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtggc 1140
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gcgcgtcagc gtttcgcgca cggcgtgcaa accgatttct ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1488
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1488
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95

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Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Ile Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Thr Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Lys Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ser Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Gly Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Phe Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1489
<211> 1488

<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1489
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcatta ggtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt ttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1490
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1490
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
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Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala

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                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Arg Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1491

<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1491
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaacccg gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1492
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1492
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80

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Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn Pro Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1493
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1493
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
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gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1494
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1494
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Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys

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65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1495
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1495
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattcttcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1496
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1496
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60

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Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Leu Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1497
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1497
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgccggg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1498
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1498
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu

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    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Arg Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
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485 490 495

<210> 1499
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1499
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccactg gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1500
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1500
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45

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Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Trp Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
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Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495


<210> 1501
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1501
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt ttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccatggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag              1488


<210> 1502
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1502
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1               5                   10                  15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20                  25                  30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
```

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        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg His Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
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465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1503
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1503
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg gggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag              1488
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<210> 1504
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1504
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Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1               5                   10                  15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20                  25                  30
```

```
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
```

Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465 470 475 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
485 490 495

<210> 1505
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1505
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagtgtctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1506
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1506
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn

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            20                  25                  30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Cys Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
```

```
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1507
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1507
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atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtcggca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag              1488
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<210> 1508
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1508
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Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1               5                   10                  15
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Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20                  25                  30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
```

Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450   455   460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465   470   475   480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485   490   495

<210> 1509
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1509
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat tatatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag   1488

<210> 1510
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1510
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp

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1               5                   10                  15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20                  25                  30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Tyr Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
```

```
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1511
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1511
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atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgctggggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag              1488
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<210> 1512
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1512

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Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1               5                  10                  15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20                  25                  30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Trp Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
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```
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1513
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1513
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattcggg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
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gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag              1488
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<210> 1514
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1514
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100   105   110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115   120   125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130   135   140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145   150   155   160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165   170   175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180   185   190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195   200   205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210   215   220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225   230   235   240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245   250   255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260   265   270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275   280   285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290   295   300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305   310   315   320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325   330   335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340   345   350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355   360   365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370   375   380
Tyr Pro Ile Asp Met Pro Ile Ile Arg Gly Leu Asp Glu Leu Ile Leu
385   390   395   400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405   410   415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly

```
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1515
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1515
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgag 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag              1488
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<210> 1516
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1516
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100   105   110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115   120   125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130   135   140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145   150   155   160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165   170   175
Ile Val Asn Glu Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180   185   190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195   200   205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210   215   220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225   230   235   240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245   250   255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260   265   270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275   280   285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290   295   300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305   310   315   320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325   330   335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340   345   350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355   360   365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370   375   380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385   390   395   400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405   410   415

```
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1517
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1517
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atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat cggatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt ttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
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gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag              1488
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<210> 1518
<211> 495
<212> PRT
<213> Artificial Sequence

<220>

<223> Variant of alpha-amylase from Escherichia coli

<400> 1518

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Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
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Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20                  25                  30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Arg Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
```

```
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
```

<210> 1519
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1519
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atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgcaggggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
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gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag              1488
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<210> 1520
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1520
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100   105   110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115   120   125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130   135   140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145   150   155   160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165   170   175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180   185   190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195   200   205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210   215   220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225   230   235   240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245   250   255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260   265   270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275   280   285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Arg Gly Arg
    290   295   300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305   310   315   320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325   330   335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340   345   350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355   360   365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370   375   380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385   390   395   400

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Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1521
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1521
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atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtacctg gtgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag              1488
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<210> 1522
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1522
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100   105   110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Trp Trp
        115   120   125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130   135   140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145   150   155   160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165   170   175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180   185   190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195   200   205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210   215   220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225   230   235   240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245   250   255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260   265   270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275   280   285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290   295   300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305   310   315   320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325   330   335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340   345   350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355   360   365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370   375   380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu

385 390 395 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
405 410 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
420 425 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
435 440 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
450 455 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465 470 475 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
485 490 495

<210> 1523
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1523
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttctga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tacacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaat tcggtaactt tgactacctg 600
atgggcgagg acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1524
<211> 495
<212> PRT

<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1524
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Leu Asn His Lys Met Gly Ala Asp Glu Lys
            100   105   110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115   120   125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130   135   140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145   150   155   160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165   170   175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180   185   190
Glu Phe Gly Asn Phe Asp Tyr Leu Met Gly Glu Asp Ile Asp Phe Arg
        195   200   205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210   215   220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225   230   235   240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245   250   255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260   265   270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275   280   285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290   295   300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305   310   315   320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325   330   335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340   345   350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355   360   365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370   375   380

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Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1525
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1525
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atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact tttgtcaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag              1488
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<210> 1526
<211> 495

<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1526
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325 330 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340 345 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355 360 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr

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    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Cys His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1527
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1527
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atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt ttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttactggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag              1488
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<210> 1528

<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1528
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100   105   110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115   120   125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130   135   140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145   150   155   160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165   170   175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180   185   190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195   200   205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210   215   220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225   230   235   240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245   250   255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260   265   270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Thr Gly Lys Thr Thr Leu Phe
        275   280   285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290   295   300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305   310   315   320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325   330   335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340   345   350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355   360   365

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Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1529
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1529
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat catatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag              1488
```

<210> 1530
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1530
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp His Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
325 330 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
340 345 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro

```
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1531
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1531
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac cgtttgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag              1488
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<210> 1532
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1532
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210 215 220
Glu Gln Thr Val Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325 330 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340 345 350

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Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1533
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1533

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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cacggaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag              1488
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<210> 1534
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1534
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
325 330 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr

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            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1535
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1535

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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttctga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaacta tgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt ttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagcttcgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcagc ataagtttca ccaggcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
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tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1536
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1536
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Leu Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Tyr Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser Phe Asp Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
275 280 285
Asp Ala Pro Leu Gln His Lys Phe His Gln Ala Ser Arg Gln Gly Arg
290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
325 330 335

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Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1537
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1537

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tggccggagc tggcggcacg tgcggaaggt ctgaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catgccaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattggggg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
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tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1538
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1538
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Glu Gly Leu Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Ala Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Gly Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu

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                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1539
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1539
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaatcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
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gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1540
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1540
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ser Asp
305 310 315 320

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Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1541
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1541
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
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gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgttgtga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1542
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1542
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp

305 310 315 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
325 330 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
340 345 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
355 360 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
370 375 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385 390 395 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
405 410 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
420 425 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
435 440 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
450 455 460
Arg Cys Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465 470 475 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
485 490 495

<210> 1543
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1543
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200

gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgattcgttt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1544
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1544
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
290 295 300

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Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Ser Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1545
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1545
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tggccggagc tggcggcacg tgcggaaggt tttaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt ttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
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gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg ggaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtattgta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1546
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1546
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Glu Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg

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    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Ile Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1547
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1547
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt ttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
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ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcatttctg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1548
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1548
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
275 280 285

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Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Ser Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1549
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1549
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
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gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg ggaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtattgta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1550
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1550
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe

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        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Ile Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1551
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1551

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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattggggg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
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ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
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gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg ggaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtattgta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1552
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1552
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Gly Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
260 265 270

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Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Ile Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1553
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1553
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga ctcgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttctga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tacacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt ttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaggcgagc 900
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cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1554
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1554
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Leu Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly

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            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1555
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1555
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttctga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840

gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1556
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1556
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Leu Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255

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Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1557
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1557
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atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattg aatgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgat 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccat gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
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tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccaggcgagc 900
cgccgtggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattcgtg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1558
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1558
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser

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                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Gln Ala Ser Arg Arg Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Arg Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1559
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1559
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atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccct gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
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ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccgtggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1560
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1560
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn Pro Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240

Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Arg Gly Arg
290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
325 330 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
340 345 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
355 360 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
370 375 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385 390 395 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
405 410 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
420 425 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
435 440 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
450 455 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465 470 475 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
485 490 495

<210> 1561
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1561
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atggtgggat gagatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660

cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg aaaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggtc accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1562
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1562
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Trp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile

225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
325 330 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
340 345 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
355 360 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
370 375 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385 390 395 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
405 410 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
420 425 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
435 440 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
450 455 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465 470 475 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
485 490 495

<210> 1563
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1563
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600

atgggcgaga acatcgattt tcgtaaccat gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt ttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccaggcgagc 900
cgccacggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattcgtg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgacgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1564
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1564
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220

Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Gln Ala Ser Arg His Gly Arg
290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
325 330 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
340 345 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
355 360 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
370 375 380
Tyr Pro Ile Asp Met Pro Ile Ile Arg Gly Leu Asp Glu Leu Ile Leu
385 390 395 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
405 410 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
420 425 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
435 440 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
450 455 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465 470 475 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
485 490 495

<210> 1565
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1565
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ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540

tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccaggcgagc 900
cgccgtggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattcgtg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgacgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1566
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1566
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Glu Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met

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    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Gln Ala Ser Arg Arg Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Arg Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1567
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1567
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ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgccgtg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480

agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccct gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccaggcgagc 900
cgctggggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattcgtg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1568
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1568
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Arg Asp Arg Arg Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205

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Asn Pro Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Gln Ala Ser Arg Trp Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Arg Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1569
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1569
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ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgccgtg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
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ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccct gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccagggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1570
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1570
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Arg Asp Arg Arg Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg

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        195                 200                 205
Asn Pro Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1571
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1571
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360

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aaccgccgtg atcgtactca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgat 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgacgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag              1488
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<210> 1572
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1572

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Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1               5                  10                  15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20                  25                  30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Arg Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
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Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
```

<210> 1573
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1573
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300

gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgccgtg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1574
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1574
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Arg Asp Arg Arg Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp

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            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1575
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1575
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240

gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgccgtg atcgtcgcca atgggatgat gaaatcattg aatgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaaccaa 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccat gcggtgaccg gggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattcgtg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1576
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1576
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Arg Asp Arg Arg Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175

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Ile Val Asn Gln Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Arg Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1577
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1577
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgaggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180

ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gagatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcagg aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattctgcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgatcaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg aaaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1578
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1578
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys

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                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Leu Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1579
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1579
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120

ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccct gcggtgaccg gggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1580
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1580
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160

Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Glu Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
325 330 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
340 345 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
355 360 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
370 375 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385 390 395 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
405 410 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
420 425 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
435 440 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
450 455 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465 470 475 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
485 490 495

<210> 1581
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1581
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60

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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgat 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccat gcggtgaccg gggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccagggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattcgtg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgacgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag              1488
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<210> 1582
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1582

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Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1               5                  10                  15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20                  25                  30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
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145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
325 330 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
340 345 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
355 360 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
370 375 380
Tyr Pro Ile Asp Met Pro Ile Ile Arg Gly Leu Asp Glu Leu Ile Leu
385 390 395 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
405 410 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
420 425 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
435 440 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
450 455 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465 470 475 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
485 490 495

<210> 1583
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1583

atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
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ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgccgtg atcgtactca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccct gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccgtggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1584
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1584
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Arg Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
130 135 140

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Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn Pro Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Arg Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1585
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1585
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgaggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atggtgggat gagatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac cgtttgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcgcg aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgatcaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg aaaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1586
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1586
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35 40 45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
    50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115 120 125
Trp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro

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    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Val Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Arg Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1587
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1587
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaaccaa 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccct gcggtgaccc tggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccaggcgagc 900
cgccgtggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgacgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1588
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1588
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35 40 45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
    50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
        115 120 125

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Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Gln Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn Pro Ala Val Thr Leu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Gln Ala Ser Arg Arg Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1589
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>

<223> Variant of alpha-amylase from Escherichia coli

<400> 1589
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ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gagatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac cgtttgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt ttaccgcga gtggattgaa cacgtgcagg aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttaccggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgatcaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcc gtaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggtc accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1590
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1590
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Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp

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        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Val Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Thr Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Arg Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1591
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1591
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ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gagatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattctgcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgatcaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg aaaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtgagc accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1592
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1592
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110

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Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Leu Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Ser Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1593
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1593
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtactca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaaccaa 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccat gcggtgaccc tggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgacgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1594
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1594
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35 40 45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
    50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys

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            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Gln Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Leu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1595
<211> 1488
<212> DNA

<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1595
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtactca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccct gcggtgaccc tggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccgtggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattcgtg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1596
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1596
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85   90   95

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Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn Pro Ala Val Thr Leu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Arg Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Arg Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1597
<211> 1488

<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1597
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat tatatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt ttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttaccggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgatcaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg aaaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggtc accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1598
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1598
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala

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                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Tyr Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Thr Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1599

<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1599
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgaggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gagatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgatcaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
cgcgatggcg aaaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1600
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1600
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80

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Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Arg Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1601
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1601
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcgcg aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgttcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgatcaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg aaaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtgagc accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1602
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1602
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys

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65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Arg Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Val Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Ser Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1603
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1603
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gagatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcgcg aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattctgcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg aaaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcggggaag ttatctag 1488

<210> 1604
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1604
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
    50   55   60

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Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Arg Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Leu Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Gly Glu Val Ile
                485                 490                 495
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<210> 1605
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1605
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgccgtg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccat gcggtgaccc tggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccaggcgagc 900
cgctggggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattcgtg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgacgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1606
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1606
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu

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    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Arg Asp Arg Arg Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Glu Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Leu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Gln Ala Ser Arg Trp Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Arg Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
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485 490 495

<210> 1607
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1607
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat cacatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac cgtttgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgttcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggtc accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1608
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1608
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45

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Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp His Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Val Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Val Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
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Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495


<210> 1609
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1609
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atgtgattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccct gcggtgaccg gggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag              1488


<210> 1610
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1610
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1               5                   10                  15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20                  25                  30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
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        35                  40                  45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp Val Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Glu Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
```

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465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1611
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1611
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atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg atggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccct gcggtgaccg gggaaatcaa atattgggcg 660
cgttggctga tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgacttcga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggtcct gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag              1488
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<210> 1612
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1612
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Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1               5                   10                  15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20                  25                  30
```

```
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Glu Tyr Thr Asn Asp Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Leu Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Phe Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Leu Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
```

Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465 470 475 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
485 490 495

<210> 1613
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1613
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacttacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacctgga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggctcga acatcgattt tcgtaaccct gcggtgaccg gggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt caagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1614
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1614
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn

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            20                  25                  30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Leu Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Glu Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Ser Asn Ile Asp Phe Arg
        195                 200                 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
```

```
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1615
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1615

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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggccggagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccct gcggtgaccg gggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag              1488
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<210> 1616
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1616

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Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1               5                   10                  15
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Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20                  25                  30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ala Gly Gly Arg Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Glu Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
```

Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450   455   460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465   470   475   480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485   490   495

<210> 1617
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1617
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg atggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccct gcggtgaccg gggaactgaa atattgggcg 660
cgttgggtga tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgacttcga tctgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
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gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggtcat gagcaacggt 1320
gacgacggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag   1488

<210> 1618
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1618
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp

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1               5                   10                  15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20                  25                  30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Glu Tyr Thr Asn Asp Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn Pro Ala Val Thr Gly Glu Leu Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Phe Asp Leu Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
```

```
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1619
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1619
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atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
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ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccct gcggtgaccg gggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggagga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag              1488
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<210> 1620
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1620

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Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1               5                  10                  15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20                  25                  30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Glu Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Glu Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
```

```
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1621
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1621

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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac gtatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccct gcggtgaccg gggaaatcaa atattgggcg 660
cgttggctga tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgacttcga tctgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
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gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag              1488
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<210> 1622
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1622
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100   105   110
Glu Arg Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
        115   120   125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
    130   135   140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145   150   155   160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165   170   175
Ile Val Asn Glu Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180   185   190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195   200   205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Leu Met
    210   215   220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225   230   235   240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245   250   255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260   265   270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275   280   285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290   295   300
Asp Phe Asp Leu Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305   310   315   320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325   330   335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340   345   350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355   360   365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370   375   380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385   390   395   400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405   410   415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly

```
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1623
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1623
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccct gcggtgaccg gggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctgcagga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag              1488
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<210> 1624
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1624
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100   105   110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
        115   120   125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
    130   135   140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145   150   155   160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165   170   175
Ile Val Asn Glu Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180   185   190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195   200   205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210   215   220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225   230   235   240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245   250   255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260   265   270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275   280   285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290   295   300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305   310   315   320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325   330   335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340   345   350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355   360   365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370   375   380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Gln Glu Leu Ile Leu
385   390   395   400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405   410   415

```
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1625
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1625
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atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtacaaagg tgatgcgggt ggctacagcg ttggctacga cacttacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacctgga gaacccgagc gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggctcga acatcgattt tcgtaaccct gcggtgaccg gggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt caagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag              1488
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<210> 1626
<211> 495
<212> PRT
<213> Artificial Sequence

<220>

<223> Variant of alpha-amylase from Escherichia coli

<400> 1626

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Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1               5                  10                  15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20                  25                  30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Asp
        35                  40                  45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Leu Glu Asn Pro Ser Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Glu Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Ser Asn Ile Asp Phe Arg
        195                 200                 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
```

```
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1627
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1627
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atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccct gcggtgaccg gggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tccgctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag              1488
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<210> 1628
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1628
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Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1               5                  10                  15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20                  25                  30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Glu Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
```

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Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile Pro
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1629
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1629
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgagtaaagg tgctgcgggt ggctacagcg ttggctacga cacttacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacctgga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaaa acatcgattt tcgtaaccct gcggtgaccg gggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt caagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgacgcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag              1488
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<210> 1630
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1630
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Ser Lys Gly Ala
        35   40   45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100   105   110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
        115   120   125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
    130   135   140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145   150   155   160
Ser Gly Ile Asp His Leu Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165   170   175
Ile Val Asn Glu Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180   185   190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195   200   205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210   215   220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225   230   235   240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245   250   255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260   265   270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275   280   285
Asp Ala Pro Leu Gln Met Lys Phe His Asp Ala Ser Arg Gln Gly Arg
    290   295   300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305   310   315   320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325   330   335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340   345   350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355   360   365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370   375   380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu

385 390 395 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
405 410 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
420 425 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
435 440 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
450 455 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465 470 475 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
485 490 495

<210> 1631
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1631
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
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ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccct gcggtgaccg gggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcagg cgaagtttca ccatgcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1632
<211> 495
<212> PRT

<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1632
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100   105   110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
        115   120   125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
    130   135   140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145   150   155   160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165   170   175
Ile Val Asn Glu Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180   185   190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195   200   205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210   215   220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225   230   235   240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245   250   255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260   265   270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275   280   285
Asp Ala Pro Leu Gln Ala Lys Phe His His Ala Ser Arg Gln Gly Arg
    290   295   300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305   310   315   320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325   330   335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340   345   350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355   360   365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370   375   380

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Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1633
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1633
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccct gcggtgaccg gggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag agatgtcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag              1488
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<210> 1634
<211> 495

<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1634
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35 40 45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
    50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
        115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
    130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165 170 175
Ile Val Asn Glu Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195 200 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Met Ser
                245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325 330 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340 345 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355 360 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr

```
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1635
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1635
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atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtacaaagg tgctgcgggt ggctacagcg ttggctacga cgcttacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacctgga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaaa acatcgattt tcgtaaccct gcggtgaccg gggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt caagcacatc 720
ccggcgtggt ttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag              1488
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<210> 1636

<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1636
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35 40 45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Ala Tyr Asp Leu Phe Asp Leu
    50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
        115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
    130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Leu Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165 170 175
Ile Val Asn Glu Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195 200 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325 330 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340 345 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355 360 365

```
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1637
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1637
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atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtacaaagg tgatgcgggt ggctacagcg ttggctacga cacttacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacatcga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaaa acatcgattt tcgtaaccct gcggtgaccg gggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt caagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag              1488
```

<210> 1638
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1638
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Asp
        35 40 45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
    50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
        115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
    130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165 170 175
Ile Val Asn Glu Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195 200 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325 330 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340 345 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro

```
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
```

<210> 1639
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1639

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atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg agggctggaa cgatgatgtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccct gcggtgaccg gggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag              1488
```

<210> 1640
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1640
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35 40 45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
    50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
        115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
    130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165 170 175
Ile Val Asn Glu Tyr Thr Asn Glu Gly Trp Asn Asp Asp Val Asp Asp
            180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195 200 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325 330 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340 345 350

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Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1641
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1641

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atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac gtatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccct gcggtgaccg gggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag              1488
```

<210> 1642
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1642
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu Arg Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Glu Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
325 330 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr

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            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1643
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1643

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atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcggcgctgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccct gcggtgaccg gggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt ttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
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tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1644
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1644
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Ala Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Glu Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
325 330 335

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Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1645
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1645

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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgctgcgggt ggctacagcg ttggctacga cgcttacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacatcga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggctcga acatcgattt tcgtaaccct gcggtgaccg gggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt caagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
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tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1646
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1646
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Ala Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Glu Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Ser Asn Ile Asp Phe Arg
195 200 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu

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                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1647
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1647

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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccct gcggtgaccg gggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
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gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcctgggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1648
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1648
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Glu Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320

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Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Leu Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1649
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1649

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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcacgatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccct gcggtgaccg gggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
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gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1650
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1650
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Thr Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Glu Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp

305 310 315 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
325 330 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
340 345 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
355 360 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
370 375 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385 390 395 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
405 410 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
420 425 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
435 440 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
450 455 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465 470 475 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
485 490 495

<210> 1651
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1651
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccct gcggtgaccg gggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200

gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacgcgg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1652
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1652
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Glu Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
290 295 300

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Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Ala Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1653
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1653
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccct gcggtgaccg gggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt ttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
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gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatat gctgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1654
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1654
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Glu Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg

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    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Met Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1655
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1655
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccct gcggtgaccg gggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
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ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttgggtag 1488

<210> 1656
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1656
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Glu Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
275 280 285

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Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Gly
                485                 490                 495
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<210> 1657
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1657
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atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccct gcggtgaccg gggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gagtccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
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gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1658
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1658
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Glu Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Ser Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe

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        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1659
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1659

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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgctgcgggt ggctacagcg ttggctacga cacttacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaaa acatcgattt tcgtaaccct gcggtgaccg gggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt caagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca caacgcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
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ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1660
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1660
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Glu Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
260 265 270

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Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Asn Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1661
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1661
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccct gcggtgaccg gggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt ttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
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cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttctttag 1488

<210> 1662
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1662
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Glu Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly

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            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Leu
                485                 490                 495
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<210> 1663
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1663
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggctcga acatcgattt tcgtaaccct gcggtgaccg gggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840

gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1664
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1664
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Glu Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Ser Asn Ile Asp Phe Arg
195 200 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255

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Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1665
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1665
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccct gcggtgaccg gggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
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tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga ggttgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1666
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1666
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Glu Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser

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                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Val Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1667
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1667
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atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccct gcggtgaccg gggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
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ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgattaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1668
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1668
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Glu Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240

Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
260 265 270
Lys Leu Ile Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
325 330 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
340 345 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
355 360 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
370 375 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385 390 395 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
405 410 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
420 425 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
435 440 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
450 455 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465 470 475 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
485 490 495

<210> 1669
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1669
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ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattta taacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccct gcggtgaccg gggaaattaa atattgggcg 660

cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1670
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1670
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Tyr Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Glu Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile

225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
325 330 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
340 345 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
355 360 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
370 375 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385 390 395 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
405 410 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
420 425 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
435 440 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
450 455 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465 470 475 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
485 490 495

<210> 1671
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1671
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggcaagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600

atgggcgaga acatcgattt tcgtaaccct gcggtgaccg gggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt ttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1672
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1672
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
130 135 140
Gly Arg Ala Gly Lys Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Glu Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220

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Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1673
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1673
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540

tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccct gcggtgaccg gggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag agaggtcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1674
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1674
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Glu Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Val Met

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    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Arg Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1675
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1675
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480

agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccct gcggtgaccg gggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta tgaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1676
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1676
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Glu Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205

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Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Met Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1677
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1677
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420

ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccct gcggtgaccg gggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgatgcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1678
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1678
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Glu Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg

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        195                 200                 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Asp Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1679
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1679
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtacaaagg tgctgcgggt ggctacagcg ttggctacga cacttacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360

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aaccgcgatg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacatcga gaacccgagc gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaaa acatcgattt tcgtaaccct gcggtgaccg gggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccacgcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag              1488
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<210> 1680
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1680

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Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1               5                  10                  15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20                  25                  30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Ser Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Glu Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
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Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
```

<210> 1681
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1681
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300

gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccct gcggtgaccg gggaaattaa atattgggcg 660
cgttgggtta tgacgcaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1682
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1682
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Glu Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp

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            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Thr Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1683
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1683
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240

gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccct gcggtgaccg gggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa gaggattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1684
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1684
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175

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Ile Val Asn Glu Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Glu Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1685
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1685
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180

ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccct gcggtgaccg gggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgattgt 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1686
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1686
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys

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                165                 170                 175
Ile Val Asn Glu Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Cys Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1687
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1687
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120

ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccct gcggtgaccg gggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcggaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1688
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1688
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160

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Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Glu Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Arg Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1689
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1689
atgctgaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60

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ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccct gcggtgaccg gggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1690
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1690
Met Leu Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe

145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Glu Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
325 330 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
340 345 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
355 360 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
370 375 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385 390 395 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
405 410 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
420 425 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
435 440 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
450 455 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465 470 475 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
485 490 495

<210> 1691
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1691

atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccct gcggtgaccg gggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggtc tgaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1692
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1692
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
130 135 140

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Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Glu Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Leu Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1693
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1693
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccct gcggtgaccg gggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
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ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
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gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
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gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1694
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1694
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro

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    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Glu Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Thr Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1695
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1695
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgaag atcgtcgcca atgggatgat gaaatcattg aatgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg atggctggaa cgatcaggtt gacgatgaac tgggtaacta tgactacctg 600
atgggcgaga acatcgattt tcgtaaccct gcggtgaccg gggaaatcaa atattgggcg 660
cgttggctga tggggcaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcaaaccta cattgatcaa 840
gttgagggta agaccacgct gttcgacgcg ccgctgcagg caaagtttca ccatgcgagc 900
cgccaaggtc gtgacttcga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctgcaaga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggtcct gagcaacggt 1320
gacgatggcg agaaaaccat tcagctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtattgta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1696
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1696
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35 40 45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
    50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Glu Asp Arg Arg Gln Trp
        115 120 125

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Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Glu Tyr Thr Asn Asp Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Tyr Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Leu Met
    210                 215                 220
Gly Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Ala Lys Phe His His Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Phe Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Gln Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Leu Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile Gln
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Ile Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1697
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>

<223> Variant of alpha-amylase from Escherichia coli

<400> 1697
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg atggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccct gcggtgaccg gggaaatcaa atattgggcg 660
cgttggctga tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt ttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgacttcga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggtcct gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1698
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1698
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp

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        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Glu Tyr Thr Asn Asp Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Leu Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Phe Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Leu Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1699
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1699
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgaag atcgtcgcca atgggatgat gaaatcattg aatgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg atggctggaa cgatcaggtt gacgatgaac tgggtaacta tgactacctg 600
atgggcgaga acatcgattt tcgtaaccct gcggtgaccg gggaaatcaa atattgggcg 660
cgttggctga tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcaaaccta cattgatcaa 840
gttgagggta agaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgacttcga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggtcct gagcaacggt 1320
gacgatggcg agaaaaccat tcatctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1700
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1700
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100   105   110

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Glu His Ile Arg Val Gln Arg Val Asn Arg Glu Asp Arg Arg Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Glu Tyr Thr Asn Asp Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Tyr Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Leu Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Phe Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Leu Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1701
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1701
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg atggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccct gcggtgaccg gggaaatcaa atattgggcg 660
cgttggctga tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgacttcga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atctgtgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggtcct gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1702
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1702
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys

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            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Glu Tyr Thr Asn Asp Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Leu Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Phe Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Cys Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Leu Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1703
<211> 1488
<212> DNA

<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1703
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg atggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccct gcggtgaccg gggaaatcaa atattgggcg 660
cgttggctga tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgacttcga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggtcct gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctttcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1704
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1704
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85   90   95

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Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Glu Tyr Thr Asn Asp Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Leu Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Phe Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Leu Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Phe Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1705
<211> 1488

<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1705
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
tatttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg atggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccct gcggtgaccg gggaaatcaa atattgggcg 660
cgttggctga tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt ttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgacttcga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggtcct gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1706
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1706
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Tyr Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala

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                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Glu Tyr Thr Asn Asp Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Leu Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Phe Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Leu Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1707

<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1707
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg atggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccct gcggtgaccg gggaaatcaa atattgggcg 660
cgttggctga tggggcaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcaaaccta cattgatcaa 840
gttgagggta agaccacgct gttcgacgcg ccgctgcagg caaagtttca caatgcgagc 900
cgccaaggtc gtgacttcga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctgcaaga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggtcct gagcaacggt 1320
gacgatggcg agaaaaccat tcatctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgttgta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggtg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1708
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1708
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80

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Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Glu Tyr Thr Asn Asp Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Leu Met
    210                 215                 220
Gly Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Ala Lys Phe His Asn Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Phe Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Gln Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Leu Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1709
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1709
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
tttccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg atggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccct gcggtgaccg gggaaatcaa atattgggcg 660
cgttggctga tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgacttcga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggtcct gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1710
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1710
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Phe Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys

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65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Glu Tyr Thr Asn Asp Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Leu Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Phe Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Leu Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1711
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1711
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgaag atcgtcgcca atgggatgat gaaatcattg aatgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccgagc gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg atggctggaa cgatcaggtt gacgatgaac tgggtaacta tgactacctg 600
atgggcgaga acatcgattt tcgtaaccct gcggtgaccg gggaaatcaa atattgggcg 660
cgttggctga tggagcaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgatcaccta cattgatcaa 840
gttgagggta agaccacgct gttcgacgcg ccgctgcaga tgaagtttca caatgcgagc 900
cgccagggtc gtgacttcga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctgcaaga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggtcct gagcaacggt 1320
gacgatggcg agaaaaccat tcagctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaaccagg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1712
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1712
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
50 55 60

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Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Glu Asp Arg Arg Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Ser Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Glu Tyr Thr Asn Asp Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Tyr Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Leu Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Ile Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Asn Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Phe Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Gln Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Leu Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile Gln
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gln Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1713
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1713
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg atggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccct gcggtgaccg gggaaatcaa atattgggcg 660
cgttggctga tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgacttcga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggtcct gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctatcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1714
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1714
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu

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    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Glu Tyr Thr Asn Asp Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Leu Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Phe Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Leu Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Tyr Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
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485 490 495

<210> 1715
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1715
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg atggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccct gcggtgaccg gggaaatcaa atattgggcg 660
cgttggctga tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgacttcga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggtcct gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1716
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1716
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45

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Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Glu Tyr Thr Asn Asp Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Leu Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Phe Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Leu Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
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Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495


<210> 1717
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1717
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattg aatgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccgagc gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg atggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccct gcggtgaccg gggaaatcaa atattgggcg 660
cgttggctga tggagcaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt ttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgatcaccta cattgatcaa 840
gttgagggta agaccacgct gttcgacgcg ccgctgcagg caaagtttca caatgcgagc 900
cgccaaggtc gtgacttcga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggtcct gagcaacggt 1320
gacgatggcg agaaaaccat tcagctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag              1488


<210> 1718
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1718
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1               5                   10                  15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20                  25                  30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
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        35                  40                  45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Ser Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Glu Tyr Thr Asn Asp Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Leu Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Ile Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Ala Lys Phe His Asn Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Phe Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Leu Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile Gln
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
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465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1719
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1719
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ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgaag atcgtcgcca atgggatgat gaaatcattg aatgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg atggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccct gcggtgaccg gggaaatcaa atattgggcg 660
cgttggctga tggagcaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcaaaccta cattgatcaa 840
gttgagggtc tgaccacgct gttcgacgcg ccgctgcagg caaagtttca ccatgcgagc 900
cgccaaggtc gtgacttcga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccaca cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctgcaaga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggtcct gagcaacggt 1320
gacgatggcg agaaaaccat tcagctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag              1488
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<210> 1720
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1720
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Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1               5                   10                  15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20                  25                  30
```

```
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Glu Asp Arg Arg Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Glu Tyr Thr Asn Asp Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Leu Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Leu Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Ala Lys Phe His His Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Phe Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Thr Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Gln Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Leu Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile Gln
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
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Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465 470 475 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
485 490 495

<210> 1721
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1721
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattg aatgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atgtcattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg atggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccct gcggtgaccg gggaaatcaa atattgggcg 660
cgttggctga tggggcaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcaaaccta cattgatcaa 840
gttgagggtc tgaccacgct gttcgacgcg ccgctgcaga tgaagtttca caatgcgagc 900
cgccaaggtc gtgacttcga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggtcct gagcaacggt 1320
gacgatggcg agaaaaccat tcatctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtattgta accgatgaaa acggcgaggc gacctttttc 1440
tgcaaccagg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1722
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1722
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn

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            20                  25                  30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp Val Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Glu Tyr Thr Asn Asp Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Leu Met
    210                 215                 220
Gly Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Leu Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Asn Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Phe Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Leu Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
```

```
    450                 455                 460
Arg Gln Glu Arg Ile Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gln Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1723
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1723
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atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acgtcgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg atggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acgtcgactt tcgtaaccct gcggtgaccg gggaaatcaa atattgggcg 660
cgttggctga tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgacttcga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagtc gtagcggtac cactgaattt ccgggctgcg ttgtggtcct gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag              1488
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<210> 1724
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1724
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Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1               5                   10                  15
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Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20                  25                  30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Val Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Glu Tyr Thr Asn Asp Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Val Asp Phe Arg
        195                 200                 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Leu Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Phe Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Leu Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
```

Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450   455   460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465   470   475   480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485   490   495

<210> 1725
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1725
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg atggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccct gcggtgaccg gggaaatcaa atattgggcg 660
cgttggctga tggaacaatg tcaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt ttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgacttcga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggtcct gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag   1488

<210> 1726
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1726
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp

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1               5                   10                  15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20                  25                  30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Glu Tyr Thr Asn Asp Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Leu Met
    210                 215                 220
Glu Gln Cys Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Phe Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Leu Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
```

```
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
```

<210> 1727
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1727
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atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg atggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acgtcgagtt tcgtaaccct gcggtgaccg gggaaatcaa atattgggcg 660
cgttggctga tggaacaaac gcaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt ttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgacttcga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggtcct gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag              1488
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<210> 1728
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1728

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Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1               5                  10                  15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20                  25                  30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Glu Tyr Thr Asn Asp Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Val Glu Phe Arg
        195                 200                 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Leu Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Phe Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
```

```
Cys Val Val Val Leu Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1729
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1729

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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga ctcgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg atggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccct gcggtgaccg gggaaatcaa atattgggcg 660
cgttggctga tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgacttcga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggtcct gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag              1488
```

<210> 1730
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1730
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Glu Tyr Thr Asn Asp Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Leu Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
290 295 300
Asp Phe Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
325 330 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
340 345 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
355 360 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
370 375 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385 390 395 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
405 410 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly

```
            420                 425                 430
Cys Val Val Val Leu Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1731
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1731
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ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg atggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acgtcgagtt tcgtaaccct gcggtgaccg gggaaatcaa atattgggcg 660
cgttggctgc tggaacaaac gcaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgacttcga tatgacccaa atcttcaccg gcagcctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggtcct gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac cttccgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttta 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag              1488
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<210> 1732
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1732
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100   105   110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
        115   120   125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
    130   135   140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145   150   155   160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165   170   175
Ile Val Asn Glu Tyr Thr Asn Asp Gly Trp Asn Asp Gln Val Asp Asp
            180   185   190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Val Glu Phe Arg
        195   200   205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Leu Leu
    210   215   220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225   230   235   240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245   250   255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260   265   270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275   280   285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290   295   300
Asp Phe Asp Met Thr Gln Ile Phe Thr Gly Ser Leu Val Glu Ala Asp
305   310   315   320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325   330   335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340   345   350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355   360   365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370   375   380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385   390   395   400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405   410   415

```
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Leu Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Phe Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Leu
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1733
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1733
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acctggcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg atggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccct gcggtgaccg gggaaatcaa atattgggcg 660
cgttggctga tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt ttaccgcga gtggattgaa cacattcaag aggtttcgcc gaagccgctg 780
tttatcgttg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aagtcacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgacttcga tatgacccaa atcttcaccg gcaccctggt tgaagcggac 960
ccggcccaca ccgtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggtcct gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag              1488
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<210> 1734
<211> 495
<212> PRT
<213> Artificial Sequence

<220>

<223> Variant of alpha-amylase from Escherichia coli

<400> 1734

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Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1               5                  10                  15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20                  25                  30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Leu Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Glu Tyr Thr Asn Asp Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Leu Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Ile Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Val Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Phe Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Thr Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
```

```
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Leu Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1735
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1735
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acgtcgcggt gattctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg atggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgactt tcgtaaccct gcggtgaccg gggaaatcaa atattgggcg 660
cgttggctga tggaacaagt acaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt ttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgacttcga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
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gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcgtcc gtagcggtac cactgaattt ccgggctgcg ttgtggtcct gagtaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag              1488
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<210> 1736
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1736
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Val Ala
                85   90   95
Val Ile Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100   105   110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
        115   120   125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
    130   135   140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145   150   155   160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165   170   175
Ile Val Asn Glu Tyr Thr Asn Asp Gly Trp Asn Asp Gln Val Asp Asp
            180   185   190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195   200   205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Leu Met
    210   215   220
Glu Gln Val Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225   230   235   240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245   250   255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260   265   270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275   280   285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290   295   300
Asp Phe Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305   310   315   320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325   330   335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340   345   350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355   360   365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370   375   380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385   390   395   400

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Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Val Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Leu Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1737
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1737
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acgtcgcggt gattctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg atggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acgtcgactt tcgtaaccct gcggtgaccg gggaaatcaa atattgggcg 660
cgttggctga tggaacaagt acaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgacttcga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcgtcc gtagcggtac cactgaattt ccgggctgcg ttgtggtcct gagtaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac cttccgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag              1488
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<210> 1738
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1738
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Val Ala
                85   90   95
Val Ile Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100   105   110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
        115   120   125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
    130   135   140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145   150   155   160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165   170   175
Ile Val Asn Glu Tyr Thr Asn Asp Gly Trp Asn Asp Gln Val Asp Asp
            180   185   190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Val Asp Phe Arg
        195   200   205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Leu Met
    210   215   220
Glu Gln Val Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225   230   235   240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245   250   255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260   265   270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275   280   285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290   295   300
Asp Phe Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305   310   315   320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325   330   335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340   345   350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355   360   365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370   375   380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu

385 390 395 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
405 410 415
Pro Asn Cys Ile Ala Phe Val Arg Ser Gly Thr Thr Glu Phe Pro Gly
420 425 430
Cys Val Val Val Leu Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
435 440 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Phe Arg Asp Phe Leu Gly Asn
450 455 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465 470 475 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
485 490 495

<210> 1739
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1739
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ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg atggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgagtt tcgtaaccct gcggtgaccg gggaaatcaa atattgggcg 660
cgttggctga tggaacaagt acaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgacttcga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggtcct gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1740
<211> 495
<212> PRT

<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1740
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100   105   110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
        115   120   125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
    130   135   140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145   150   155   160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165   170   175
Ile Val Asn Glu Tyr Thr Asn Asp Gly Trp Asn Asp Gln Val Asp Asp
            180   185   190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Glu Phe Arg
        195   200   205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Leu Met
    210   215   220
Glu Gln Val Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225   230   235   240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245   250   255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260   265   270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275   280   285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290   295   300
Asp Phe Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305   310   315   320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325   330   335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340   345   350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355   360   365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370   375   380

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Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Leu Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1741
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1741
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catgatctgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgaca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg atggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccct gcggtgaccg gggaaatcaa atattgggcg 660
cgttggctga tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgttg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaactacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgacttcga tatgacccaa atcttcaccg gcaccctggt tgaagcggac 960
ccggcccaca ccgtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg attattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcgtc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggtcct gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag              1488
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<210> 1742
<211> 495

<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1742
Met Arg Asn Pro Thr Ile Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Ile Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Asp Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Glu Tyr Thr Asn Asp Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Leu Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
290 295 300
Asp Phe Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320
Pro Ala His Thr Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
325 330 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
340 345 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
355 360 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr

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    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Val Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Leu Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
```

<210> 1743
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1743
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atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg atggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgagtt tcgtaaccct gcggtgaccg gggaaatcaa atattgggcg 660
cgttggctga tggaacaagt acaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt ttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgacttcga tatgacccaa atcttcaccg gcagcctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcgtcc gtagcggtac cactgaattt ccgggctgcg ttgtggtcct gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag              1488
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<210> 1744

<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1744
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100   105   110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
        115   120   125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
    130   135   140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145   150   155   160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165   170   175
Ile Val Asn Glu Tyr Thr Asn Asp Gly Trp Asn Asp Gln Val Asp Asp
            180   185   190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Glu Phe Arg
        195   200   205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Leu Met
    210   215   220
Glu Gln Val Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225   230   235   240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245   250   255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260   265   270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275   280   285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290   295   300
Asp Phe Asp Met Thr Gln Ile Phe Thr Gly Ser Leu Val Glu Ala Asp
305   310   315   320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325   330   335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340   345   350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355   360   365

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Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Val Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Leu Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1745
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1745

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atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcgcca atgggatgat gaaatcattc gttgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg atggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acatcgattt tcgtaaccct gcggtgaccg gggaaatcaa atattgggcg 660
cgttggctga tggggcaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgatcaccta cattgatcaa 840
gttgagggta agaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgctggggtc gtgacttcga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggtcct gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag              1488
```

<210> 1746
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1746
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100   105   110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Arg Gln Trp
        115   120   125
Asp Asp Glu Ile Ile Arg Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
    130   135   140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145   150   155   160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165   170   175
Ile Val Asn Glu Tyr Thr Asn Asp Gly Trp Asn Asp Gln Val Asp Asp
            180   185   190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195   200   205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Leu Met
    210   215   220
Gly Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225   230   235   240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245   250   255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260   265   270
Lys Leu Ile Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275   280   285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Trp Gly Arg
    290   295   300
Asp Phe Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305   310   315   320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325   330   335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340   345   350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro

```
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Leu Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
```

<210> 1747
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1747

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atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtaatca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg atggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acgtcgagtt tcgtaaccct gcggtgaccg gggaaatcaa atattgggcg 660
cgttggctga tggaacaaac gcaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgacttcga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggtcct gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag              1488
```

<210> 1748
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1748
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Asn Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Glu Tyr Thr Asn Asp Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Val Glu Phe Arg
195 200 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Leu Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
290 295 300
Asp Phe Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
325 330 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
340 345 350

```
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Leu Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
```

<210> 1749
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1749

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atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtctgca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg atggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acgtcgagtt tcgtaaccct gcggtgaccg gggaaatcaa atattgggcg 660
cgttggctga tggaacaaac gcaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgacttcga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggtcct gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag              1488
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<210> 1750
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1750
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Leu Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Glu Tyr Thr Asn Asp Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Val Glu Phe Arg
195 200 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Leu Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
290 295 300
Asp Phe Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
325 330 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr

```
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Leu Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1751
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1751

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atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtcagca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg atggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acgtcgagtt tcgtaaccct gcggtgaccg gggaaatcaa atattgggcg 660
cgttggctga tggaacaaac gcaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt ttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgacttcga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggtcct gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
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tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1752
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1752
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Gln Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Glu Tyr Thr Asn Asp Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Val Glu Phe Arg
195 200 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Leu Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
290 295 300
Asp Phe Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
325 330 335

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Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Leu Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1753
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1753

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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtaagca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg atggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acgtcgagtt tcgtaaccct gcggtgaccg gggaaatcaa atattgggcg 660
cgttggctga tggaacaaac gcaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgacttcga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggtcct gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
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tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1754
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1754
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Lys Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Glu Tyr Thr Asn Asp Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Val Glu Phe Arg
195 200 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Leu Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
290 295 300
Asp Phe Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu

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                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Leu Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1755
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1755
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgttgtca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg atggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acgtcgagtt tcgtaaccct gcggtgaccg gggaaatcaa atattgggcg 660
cgttggctga tggaacaaac gcaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgacttcga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggtcct gagcaacggt 1320
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gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1756
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1756
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Cys Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Glu Tyr Thr Asn Asp Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Val Glu Phe Arg
195 200 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Leu Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
290 295 300
Asp Phe Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320

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Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Leu Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1757
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1757

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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtactca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg atggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acgtcgagtt tcgtaaccct gcggtgaccg gggaaatcaa atattgggcg 660
cgttggctga tggaacaaac gcaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgacttcga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
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gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggtcct gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctga 1488

<210> 1758
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1758
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Glu Tyr Thr Asn Asp Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Val Glu Phe Arg
195 200 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Leu Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
290 295 300
Asp Phe Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp

305 310 315 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
325 330 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
340 345 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
355 360 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
370 375 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385 390 395 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
405 410 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
420 425 430
Cys Val Val Val Leu Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
435 440 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
450 455 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465 470 475 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
485 490 495

<210> 1759
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1759
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtagtca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg atggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acgtcgagtt tcgtaaccct gcggtgaccg gggaaatcaa atattgggcg 660
cgttggctga tggaacaaac gcaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgacttcga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200

gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggtcct gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1760
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1760
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Ser Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Glu Tyr Thr Asn Asp Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Val Glu Phe Arg
195 200 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Leu Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
290 295 300

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Asp Phe Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Leu Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1761
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1761
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atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgttggca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg atggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acgtcgagtt tcgtaaccct gcggtgaccg gggaaatcaa atattgggcg 660
cgttggctga tggaacaaac gcaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt ttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgacttcga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
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gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggtcct gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1762
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1762
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Trp Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Glu Tyr Thr Asn Asp Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Val Glu Phe Arg
195 200 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Leu Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg

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    290                 295                 300
Asp Phe Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Leu Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1763
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1763
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atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtatgca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg atggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acgtcgagtt tcgtaaccct gcggtgaccg gggaaatcaa atattgggcg 660
cgttggctga tggaacaaac gcaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt ttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgacttcga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc taattctgct gcgtgagaat 1080
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ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggtcct gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1764
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1764
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Met Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Glu Tyr Thr Asn Asp Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Val Glu Phe Arg
195 200 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Leu Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
275 280 285

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Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Phe Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Leu Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1765
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1765
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtgagca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg atggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acgtcgagtt tcgtaaccct gcggtgaccg gggaaatcaa atattgggcg 660
cgttggctga tggaacaaac gcaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgacttcga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
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gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggtcct gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1766
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1766
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Glu Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Glu Tyr Thr Asn Asp Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Val Glu Phe Arg
195 200 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Leu Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe

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        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Phe Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Leu Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1767
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1767
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcggcgggt ggctacagcg ttggctacga cacgtacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtca accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgatg atcgtgatca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
ttcacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgaa 540
tataccaatg atggctggaa cgatcaggtt gacgatgaac tgggtaactt tgactacctg 600
atgggcgaga acgtcgagtt tcgtaaccct gcggtgaccg gggaaatcaa atattgggcg 660
cgttggctga tggaacaaac gcaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca ccatgcgagc 900
cgccaaggtc gtgacttcga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
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ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cactgaattt ccgggctgcg ttgtggtcct gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1768
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1768
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ala Gly Gly Tyr Ser Val Gly Tyr Asp Thr Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Asp Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Phe Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Glu Tyr Thr Asn Asp Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Val Glu Phe Arg
195 200 205
Asn Pro Ala Val Thr Gly Glu Ile Lys Tyr Trp Ala Arg Trp Leu Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
260 265 270

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Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His His Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Phe Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Thr Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Leu Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1769
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1769
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt ttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
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cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggccggcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1770
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1770
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly

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            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Arg Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1771
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1771
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840

gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaactggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1772
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1772
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255

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Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Leu Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1773
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1773
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
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tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa ccttgccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1774
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1774
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser

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                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Leu Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1775
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1775

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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
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ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
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gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt tttaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1776
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1776
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240

Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
325 330 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
340 345 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
355 360 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
370 375 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385 390 395 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
405 410 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
420 425 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
435 440 445
Leu Gly Phe Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
450 455 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465 470 475 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
485 490 495

<210> 1777
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1777
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaaccag 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660

cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
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gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
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gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1778
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1778
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Gln Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile

225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
325 330 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
340 345 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
355 360 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
370 375 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385 390 395 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
405 410 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
420 425 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
435 440 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
450 455 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465 470 475 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
485 490 495

<210> 1779
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1779
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600

atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt ttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggctggcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1780
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1780
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220

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Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Trp Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1781
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1781
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540

tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt ttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttaggggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1782
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1782
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met

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    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Arg Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1783
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1783
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tataccttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480

agcggtatcg atcacattga gaacccggac gaaaagggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1784
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1784
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Lys Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205

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Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1785
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1785

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atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
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tataccttтc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
acgtgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1786
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1786
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg

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        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Thr Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1787
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1787
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360

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aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcggtgaag ttatctag             1488
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<210> 1788
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1788

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Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1               5                  10                  15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20                  25                  30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
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Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Gly Glu Val Ile
                485                 490                 495
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<210> 1789
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1789
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300

gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tataccttтc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgcgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1790
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1790
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp

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            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Ala Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1791
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1791
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240

gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccag gtgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1792
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1792
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1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Arg Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175

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Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1793
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1793
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180

ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgtgcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1794
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1794
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys

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                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Val Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495


<210> 1795
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1795
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgggcaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1796
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1796
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160

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Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Gly His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1797
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1797
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60

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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcc gtaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag              1488
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<210> 1798
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1798

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Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1               5                  10                  15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20                  25                  30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
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145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Arg Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1799
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1799

atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcatttggg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1800
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1800
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140

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Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Trp Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1801
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1801
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccggt ggacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1802
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1802
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro

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    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Val Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1803
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1803
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gactggggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1804
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1804
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125

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Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Trp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1805
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>

<223> Variant of alpha-amylase from Escherichia coli

<400> 1805
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggaccgtg 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1806
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1806
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp

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        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Val Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1807
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1807
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtgctg accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1808
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1808
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100   105   110

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Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Leu Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1809
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1809
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcggg aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1810
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1810
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys

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            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Arg Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1811
<211> 1488
<212> DNA

<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1811
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catgggaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1812
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1812
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Gly Asn Asp Ile Ala
                85   90   95

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Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1813
<211> 1488

<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1813
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt ttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagcc gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1814
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1814
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala

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                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Pro Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1815

<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1815
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcactaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1816
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1816
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80

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Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Thr Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1817
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1817
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccc tggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1818
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1818
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys

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65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Leu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1819
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1819
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg ggaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1820
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1820
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60

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Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Gly Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1821
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1821
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtgggg accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1822
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1822
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu

```
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Gly Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
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485 490 495

<210> 1823
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1823
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtgtct accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1824
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1824
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45

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Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Ser Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
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Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495


<210> 1825
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1825
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgggg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt ttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag              1488


<210> 1826
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1826
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1               5                   10                  15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20                  25                  30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
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        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Gly Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
```

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465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1827
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1827
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atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atccgggaag ttatctag              1488
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<210> 1828
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1828
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Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1               5                   10                  15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20                  25                  30
```

```
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
```

Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465 470 475 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Arg Glu Val Ile
485 490 495

<210> 1829
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1829
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg ttaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1830
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1830
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn

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            20                  25                  30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Val Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
```

```
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1831
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1831

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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
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gacaggggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag              1488
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<210> 1832
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1832

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1               5                   10                  15
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Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20                  25                  30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Arg Gly Glu Lys Thr Ile His
        435                 440                 445
```

```
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1833
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1833
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atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt ttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtcggtatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
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gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag              1488
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<210> 1834
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1834
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Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
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1               5                   10                  15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20                  25                  30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Arg Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
```

```
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
```

<210> 1835
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1835
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccat ttgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
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cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
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gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag              1488
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<210> 1836
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1836

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Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1               5                  10                  15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20                  25                  30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Ile Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
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```
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1837
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1837

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atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gttggtatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag              1488
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<210> 1838
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1838
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100   105   110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115   120   125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130   135   140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145   150   155   160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165   170   175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180   185   190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195   200   205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210   215   220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225   230   235   240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245   250   255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260   265   270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275   280   285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290   295   300
Trp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305   310   315   320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325   330   335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340   345   350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355   360   365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370   375   380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385   390   395   400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405   410   415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly

```
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
```

<210> 1839
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1839
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagtggctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag              1488
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<210> 1840
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1840
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100   105   110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115   120   125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130   135   140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145   150   155   160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165   170   175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180   185   190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195   200   205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210   215   220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225   230   235   240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245   250   255
Pro Lys Trp Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260   265   270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275   280   285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290   295   300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305   310   315   320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325   330   335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340   345   350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355   360   365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370   375   380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385   390   395   400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405   410   415

```
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1841
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1841
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atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt ttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgggaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag              1488
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<210> 1842
<211> 495
<212> PRT
<213> Artificial Sequence

<220>

<223> Variant of alpha-amylase from Escherichia coli

<400> 1842

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Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1               5                  10                  15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20                  25                  30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Gly Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
```

```
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1843
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1843

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atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atggtgggat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt ttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
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tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag              1488
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<210> 1844
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1844
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Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1               5                  10                  15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20                  25                  30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Trp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
```

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Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1845
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1845
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
cgtgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag              1488
```

<210> 1846
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1846
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Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1               5                  10                  15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20                  25                  30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
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385 390 395 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
405 410 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
420 425 430
Cys Val Val Val Met Ser Asn Gly Arg Asp Gly Glu Lys Thr Ile His
435 440 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
450 455 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465 470 475 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
485 490 495

<210> 1847
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1847
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaggaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1848
<211> 495
<212> PRT

<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1848
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1   5   10   15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20   25   30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35   40   45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50   55   60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65   70   75   80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85   90   95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100   105   110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115   120   125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130   135   140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145   150   155   160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165   170   175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180   185   190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195   200   205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210   215   220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225   230   235   240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245   250   255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260   265   270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275   280   285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290   295   300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305   310   315   320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325   330   335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340   345   350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355   360   365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370   375   380

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Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Arg Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
```

<210> 1849
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1849
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatatga acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag              1488
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<210> 1850
<211> 495

<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1850
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325 330 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340 345 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355 360 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr

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    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Met Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1851
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1851

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atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt ttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaagggat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag              1488
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<210> 1852

<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1852
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325 330 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340 345 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355 360 365

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Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Gly Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1853
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1853

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atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt ttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgcgtact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag              1488
```

<210> 1854
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1854
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
325 330 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
340 345 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro

```
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Ala Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
```

<210> 1855
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1855

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atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccgt gtgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag              1488
```

<210> 1856
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1856
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Val Trp
        115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325 330 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340 345 350

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Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
```

<210> 1857
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1857

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atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgacca gggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag              1488
```

<210> 1858
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1858
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Arg Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
325 330 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr

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            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1859
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1859

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atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atggtgtgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt ttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
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tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1860
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1860
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Cys Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
325 330 335

```
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1861
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1861

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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtacctc ttgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
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tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1862
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1862
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Ser Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu

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                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1863
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1863
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg cttgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
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gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1864
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1864
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Ala Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320

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Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1865
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1865
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgcgtgggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
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gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1866
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1866
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Val Gly Arg
290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp

305 310 315 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
325 330 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
340 345 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
355 360 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
370 375 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385 390 395 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
405 410 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
420 425 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
435 440 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
450 455 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465 470 475 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
485 490 495

<210> 1867
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1867
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200

gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagtg gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1868
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1868
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
290 295 300

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Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Trp Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1869
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1869

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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt ttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
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gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gccttaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1870
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1870
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg

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    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Leu Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1871
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1871
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atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt ttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
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ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaag ggggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1872
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1872
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
275 280 285

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Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Gly Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1873
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1873
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atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaaaggggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
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gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1874
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1874
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Arg Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe

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        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1875
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1875
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atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggta cggactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
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ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1876
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1876
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
260 265 270

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Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Thr
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1877
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1877
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcagaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt ttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
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cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1878
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1878
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Gln Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly

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            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1879
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1879
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840

gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccgaggcacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1880
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1880
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255

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Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Arg His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1881
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1881
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag gggtttcgcc gaagccgctg 780
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tttatcgtgg cggagtattg gagccacgac gttggcaagc tacagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1882
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1882
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Gly Val Ser

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                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1883
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1883
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
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ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gctggaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1884
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1884
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225 230 235 240

Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
325 330 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
340 345 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
355 360 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
370 375 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385 390 395 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
405 410 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
420 425 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
435 440 445
Leu Gly Glu Asn Tyr Gly Trp Lys Thr Trp Arg Asp Phe Leu Gly Asn
450 455 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465 470 475 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
485 490 495

<210> 1885
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1885
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacccg 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660

cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1886
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1886
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Pro Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile

225 230 235 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
245 250 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
260 265 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
275 280 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
290 295 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305 310 315 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
325 330 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
340 345 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
355 360 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
370 375 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385 390 395 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
405 410 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
420 425 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
435 440 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
450 455 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465 470 475 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
485 490 495

<210> 1887
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1887
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600

atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt ttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
tgggatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1888
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1888
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
210 215 220

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Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Trp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1889
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1889
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540

tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
gtgtgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1890
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1890
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Val Trp Val Met

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    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1891
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1891
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tataccttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480

agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgggttt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1892
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1892
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
195 200 205

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Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Gly Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1893
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1893
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420

tataccttтc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccggg ggacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1894
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1894
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
180 185 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg

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        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Gly Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1895
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1895
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360

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agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaacggt gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt ttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
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ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
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gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag              1488
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<210> 1896
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1896

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Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
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Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn Gly Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1897
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1897
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300

gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgctgtg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tataccttтc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1898
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1898
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Cys Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp

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            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1899
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1899
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240

gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
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tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1900
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1900
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
165 170 175

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Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Met
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1901
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1901
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180

ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtcagca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
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tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
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gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
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tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1902
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1902
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Gln Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys

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                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1903
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1903
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120

ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattt tttgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1904
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1904
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Phe Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145 150 155 160

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Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1905
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1905
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ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaat gtatctag              1488
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<210> 1906
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1906

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Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1               5                  10                  15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
            20                  25                  30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
        35                  40                  45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
    50                  55                  60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65                  70                  75                  80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
                85                  90                  95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
            100                 105                 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
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145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Cys Ile
                485                 490                 495
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<210> 1907
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1907

atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagccgctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgcgggggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
gcgccggttg aaccgtggtt caagcctctg gcgtatgcgc tgattctgct gcgtgagaat 1080
ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
gacggcgaaa cctacccgat cgacatgccg atcattgagg gtctggatga actgattctg 1200
gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
gcgttcagcc gtagcggtac cgatgaattt ccgggctgcg ttgtggttat gagcaacggt 1320
gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1908
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1908
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1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
130 135 140

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Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gly Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1909
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1909
atgcgcaacc cgaccctgct gcaatgcttt cactggtact acccggatgg cggtaaactg 60
tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
gcgcaactgc tggcggcgat cgatgcgctg catcgtaacg acattgcggt gctgctggat 300
gtggttgtga accacaagat gggcgcggac gagaaagaac atatccgtgt gcagcgtgtt 360
aaccgcgacg atcgtaccca atgggatgat gaaatcattg agtgcgaagg ttggacccgt 420
tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
tataccaatg agggctggaa cgatcaggtt gacgatgaac tgggtaactt cgactacctg 600
atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
ccggcgtggt tttaccgcga gtggattgaa cacgtgcaag aggtttcgcc gaagcgtctg 780
tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
gttgagggta aaaccacgct gttcgacgcg ccgctgcaga tgaagtttca cgaagcgagc 900
cgccaaggtc gtgactatga tatgacccaa atcttcaccg gcaccctggt ggaagcggac 960
ccggcccacg cggtgaccct ggttgcgaac cacgataccc aaccgctgca agcgctggag 1020
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gcgcgtcagc gtttcgcgca cggcgtgcaa accgattact ttgaccaccc gaactgcatc 1260
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gacgatggcg agaaaaccat tcacctgggt gaaaactacg gcaacaagac ctggcgtgac 1380
tttctgggta accgtcagga gcgtgtggta accgatgaaa acggcgaggc gacctttttc 1440
tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1910
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1910
Met Arg Asn Pro Thr Leu Leu Gln Cys Phe His Trp Tyr Tyr Pro Asp
1 5 10 15
Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro

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    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Arg Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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<210> 1911
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1911
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tggccggagc tggcggcacg tgcgcgtggt ttcaacgaga tcggcattaa catggtgtgg 120
ctgccgccgg cgtataaagg tgcgagcggt ggctacagcg ttggctacga cagctacgac 180
ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
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tatacctttc cgggccgtgc gggccagtac agccaattta tctgggacta tcgctgcttt 480
agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
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cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
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<210> 1912
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1912
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Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp
115 120 125

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Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
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Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Asp Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Trp Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
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<210> 1913
<211> 1488
<212> DNA
<213> Artificial Sequence

<220>

<223> Variant of alpha-amylase from Escherichia coli

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ctgttcgacc tgggcgagtt tgaccagaaa ggcagcatcc cgaccaagta cggtgataaa 240
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agcggtatcg atcacattga gaacccggac gaagatggca tcttcaagat tgtcaacgac 540
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atgggcgaga acatcgattt tcgtaaccac gcggtgaccg aggaaattaa atattgggcg 660
cgttgggtta tggaacaaac ccaatgcgat ggtttccgtc tggacgcggt gaagcacatc 720
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tttatcgtgg cggagtattg gagccacgac gttggcaagc tgcagaccta cattgatcaa 840
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ggtgtgccga gcgtgttcta cccggacctg ttcggtgcgc actacgaaga tgtgggtcgc 1140
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tgcaacggcg gtagcgtgag cgtgtgggtg atcgaggaag ttatctag 1488

<210> 1914
<211> 495
<212> PRT
<213> Artificial Sequence

<220>
<223> Variant of alpha-amylase from Escherichia coli

<400> 1914
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Gly Gly Lys Leu Trp Pro Glu Leu Ala Ala Arg Ala Arg Gly Phe Asn
20 25 30
Glu Ile Gly Ile Asn Met Val Trp Leu Pro Pro Ala Tyr Lys Gly Ala
35 40 45
Ser Gly Gly Tyr Ser Val Gly Tyr Asp Ser Tyr Asp Leu Phe Asp Leu
50 55 60
Gly Glu Phe Asp Gln Lys Gly Ser Ile Pro Thr Lys Tyr Gly Asp Lys
65 70 75 80
Ala Gln Leu Leu Ala Ala Ile Asp Ala Leu His Arg Asn Asp Ile Ala
85 90 95
Val Leu Leu Asp Val Val Val Asn His Lys Met Gly Ala Asp Glu Lys
100 105 110
Glu His Ile Arg Val Gln Arg Val Asn Arg Asp Asp Arg Thr Gln Trp

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        115                 120                 125
Asp Asp Glu Ile Ile Glu Cys Glu Gly Trp Thr Arg Tyr Thr Phe Pro
    130                 135                 140
Gly Arg Ala Gly Gln Tyr Ser Gln Phe Ile Trp Asp Tyr Arg Cys Phe
145                 150                 155                 160
Ser Gly Ile Asp His Ile Glu Asn Pro Asp Glu Asp Gly Ile Phe Lys
                165                 170                 175
Ile Val Asn Asp Tyr Thr Asn Glu Gly Trp Asn Asp Gln Val Asp Asp
            180                 185                 190
Glu Leu Gly Asn Phe Asp Tyr Leu Met Gly Glu Asn Ile Asp Phe Arg
        195                 200                 205
Asn His Ala Val Thr Glu Glu Ile Lys Tyr Trp Ala Arg Trp Val Met
    210                 215                 220
Glu Gln Thr Gln Cys Asp Gly Phe Arg Leu Asp Ala Val Lys His Ile
225                 230                 235                 240
Pro Ala Trp Phe Tyr Arg Glu Trp Ile Glu His Val Gln Glu Val Ser
                245                 250                 255
Pro Lys Pro Leu Phe Ile Val Ala Glu Tyr Trp Ser His Asp Val Gly
            260                 265                 270
Lys Leu Gln Thr Tyr Ile Asp Gln Val Glu Gly Lys Thr Thr Leu Phe
        275                 280                 285
Asp Ala Pro Leu Gln Met Lys Phe His Glu Ala Ser Arg Gln Gly Arg
    290                 295                 300
Gln Tyr Asp Met Thr Gln Ile Phe Thr Gly Thr Leu Val Glu Ala Asp
305                 310                 315                 320
Pro Ala His Ala Val Thr Leu Val Ala Asn His Asp Thr Gln Pro Leu
                325                 330                 335
Gln Ala Leu Glu Ala Pro Val Glu Pro Trp Phe Lys Pro Leu Ala Tyr
            340                 345                 350
Ala Leu Ile Leu Leu Arg Glu Asn Gly Val Pro Ser Val Phe Tyr Pro
        355                 360                 365
Asp Leu Phe Gly Ala His Tyr Glu Asp Val Gly Arg Asp Gly Glu Thr
    370                 375                 380
Tyr Pro Ile Asp Met Pro Ile Ile Glu Gly Leu Asp Glu Leu Ile Leu
385                 390                 395                 400
Ala Arg Gln Arg Phe Ala His Gly Val Gln Thr Asp Tyr Phe Asp His
                405                 410                 415
Pro Asn Cys Ile Ala Phe Ser Arg Ser Gly Thr Asp Glu Phe Pro Gly
            420                 425                 430
Cys Val Val Val Met Ser Asn Gly Asp Asp Gly Glu Lys Thr Ile His
        435                 440                 445
Leu Gly Glu Asn Tyr Gly Asn Lys Thr Trp Arg Asp Phe Leu Gly Asn
    450                 455                 460
Arg Gln Glu Arg Val Val Thr Asp Glu Asn Gly Glu Ala Thr Phe Phe
465                 470                 475                 480
Cys Asn Gly Gly Ser Val Ser Val Trp Val Ile Glu Glu Val Ile
                485                 490                 495
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