(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 3 339 416 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
27.06.2018 Bulletin 2018/26

(51) Int Cl.:
C11D 3/10 *(2006.01)* ***C11D 3/386*** *(2006.01)*
C11D 17/00 *(2006.01)*

(21) Application number: **17173004.7**

(22) Date of filing: **26.05.2017**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
MA MD

(30) Priority: **22.12.2016 EP 16206487**

(71) Applicant: **The Procter & Gamble Company**
Cincinnati, OH 45202 (US)

(72) Inventors:
- **LANT, Neil Joseph**
  Newcastle upon Tyne, NE12 9TS (GB)
- **BROOKER, Alan Thomas**
  Newcastle upon Tyne, NE12 9TS (GB)

(74) Representative: **Howard, Phillip Jan**
Procter & Gamble
Technical Centres Limited
Whitley Road
Longbenton
Newcastle upon Tyne NE12 9TS (GB)

(54) LAUNDRY DETERGENT COMPOSITION

(57) The present invention relates to a solid laundry detergent composition comprising:
(a) from 20wt% to 39wt% detersive surfactant selected from anionic detersive surfactant and/or non-ionic detersive surfactant;
(b) from 10wt% to 40wt% inorganic salts selected from sodium carbonate, sodium sesquicarbonate, sodium bicarbonate and any mixtures thereof;
(c) optionally, from 10wt% to 40wt% citric acid and/or salts thereof;
(d) from 0.001wt% to 1.0wt% metalloprotease enzyme,
wherein at 1wt% dilution in de-ionised water at 20°C, the composition has a pH in the range of from 7.6 to 10.0;
wherein at 1wt% dilution in de-ionised water at 20°C, the composition has a reserve alkalinity to pH 7.5 of greater than 3.0,
wherein the composition is in the form of a coated laundry detergent particle that is curved and has perpendicular dimensions x, y and z,
wherein x is from 0.5mm to 2.0mm,
wherein y is from 2.0mm to 8.0mm, and
wherein z is from 2.0mm to 8.0mm,
wherein the coating comprises the inorganic salt (b), and wherein the core comprises the detersive surfactant (a).

EP 3 339 416 A1

Description

FIELD OF THE INVENTION

[0001] The present invention relates to laundry detergent compositions, especially laundry detergent powders having a low pH profile that also comprise carbonate salt. The laundry detergent compositions of the present invention provide good cleaning performance.

BACKGROUND OF THE INVENTION

[0002] Laundry detergent powders are typically formulated at quite high alkaline pH, for example a pH in the range of 10.5 to 12.0. Cleaning chemistries that are incorporated into laundry detergent powders are typically designed to provide good cleaning performance, and oftentimes even optimized cleaning performance, at this pH range.

[0003] Recently, laundry detergent powder manufacturers are designing products that are formulated to a much lower pH range, such as from 7.6 to 10.0. Such laundry detergent powders provide good fabric care performance. However, the cleaning performance of these lower pH laundry powder formulations needs to be carefully considered. Cleaning chemistries that provide good cleaning performance at high pH wash conditions do not always provide good cleaning performance at low pH wash conditions. Consequently, the cleaning performance of low pH laundry detergent powders is reduced.

[0004] In addition, one of the main formulation chassis approaches to lowering the pH profile of a laundry detergent powder is to lower, or even remove, carbonate salt from the product. The presence of carbonate anion in the wash impacts the cleaning performance of some cleaning chemistries typically formulated in the laundry detergent powder. Consequently, the removal of carbonate salt leads to a formulation strategy of using cleaning chemistries that provide good cleaning performance at both a low pH wash condition and also a low carbonate anion wash level.

[0005] However, the present invention differs from this recent low pH laundry powder formulation approach in that the present invention seeks to provide a low pH laundry detergent powder that has a low pH profile, and that provides good cleaning performance, and that also comprises carbonate salt. This requires a formulation approach of including of cleaning technologies that provide good cleaning performance at low wash pH and that also provide good cleaning performance in the presence of carbonate salt. The presence of carbonate salt in the product aids the performance of the product, for example by providing precipitating builder performance or by providing effervescence performance which leads to improved dispensing/dissolution performance, especially in cold and quick wash cycles.

[0006] In addition, when these products are in a coated lenticular form, due to the particle architecture of this product form, the cleaning performance of the product needs to be improved, especially in stressed washed conditions such as cold and quick wash cycles. The present invention addresses this problem.

SUMMARY OF THE INVENTION

[0007] The present invention provides a solid laundry detergent composition comprising:

(a) from 20wt% to 39wt% detersive surfactant selected from anionic detersive surfactant and/or non-ionic detersive surfactant;
(b) from 10wt% to 40wt% inorganic salts selected from sodium carbonate, sodium sesquicarbonate, sodium bicarbonate and any mixtures thereof;
(c) optionally, from 10wt% to 40wt% citric acid and/or salts thereof;
(d) from 0.001wt% to 1.0wt% metalloprotease enzyme,

wherein at 1wt% dilution in de-ionised water at 20°C, the composition has a pH in the range of from 7.6 to 10.0,
wherein at 1wt% dilution in de-ionised water at 20°C, the composition has a reserve alkalinity to pH 7.5 of greater than 3.0,
wherein the composition is in the form of a coated laundry detergent particle that is curved and has perpendicular dimensions x, y and z,
wherein x is from 0.5mm to 2.0mm,
wherein y is from 2.0mm to 8.0mm, and
wherein z is from 2.0mm to 8.0mm,
wherein the coating comprises the inorganic salt (b), and wherein the core comprises the detersive surfactant (a).

DETAILED DESCRIPTION OF THE INVENTION

[0008] **Solid laundry detergent composition:** The solid laundry detergent composition comprises:

(a) from 20wt% to 39wt% detersive surfactant selected from anionic detersive surfactant and/or non-ionic detersive surfactant;
(b) from 10wt% to 40wt% inorganic salts selected from sodium carbonate, sodium sesquicarbonate, sodium bicarbonate and any mixtures thereof;
(c) optionally, from 10wt% to 40wt% citric acid and/or salts thereof;
(d) from 0.001wt% to 1.0wt% metalloprotease enzyme,

wherein at 1wt% dilution in de-ionised water at 20°C, the composition has a pH in the range of from 7.6 to 10.0,
wherein at 1wt% dilution in de-ionised water at 20°C, the composition has a reserve alkalinity to pH 7.5 of greater than 3.0,
wherein the composition is in the form of a coated laundry detergent particle that is curved and has perpendicular dimensions x, y and z,
wherein x is from 0.5mm to 2.0mm,
wherein y is from 2.0mm to 8.0mm, and
wherein z is from 2.0mm to 8.0mm,
wherein the coating comprises the inorganic salt (b), and wherein the core comprises the detersive surfactant (a).
The coated laundry detergent particle may be lenticular (e.g. shaped like a whole dried lentil), an oblate ellipsoid, and where z and y are the equatorial diameters and x is the polar diameter; preferably y = z.

[0009] Typically, when x = 2mm, then at least one of z or y = >2mm, and preferably >3mm.The dimensions x, y and z can be measured using image analysis. Suitable equipment for image analysis includes a Leica Binocular Microscope (Leica MZ16A) with motorised and indexed mount, using a digital camera (Leica IC30) to capture the images, the images would be processed within the LEICA Application Software (LAS) platform using the optional Montage MultiFocus and Analysis modules.

[0010] The X and y axial size can be determined by pixel count analysis of the Feret diameters with the maximum and minimum Feret Diameters representing the X and Y axial lengths.

[0011] The Z axial length can be determined via the use of focus stacking (i.e. z-stacked images) which is a digital image processing technique which combines multiple images taken at different known focus distances to give a resulting image with a greater depth of field (DOF) than any of the individual source images.

[0012] A suitable method for making the detergent particle is described in WO2010/122050.

[0013] The coated laundry detergent particle may be shaped as a disc. Preferably the coated laundry detergent particle does not have hole; that is to say, the coated laundry detergent particle does not have a conduit that passes through the core: i.e. the coated detergent particle has a topologic genus of zero.

[0014] The composition may comprise from 0.05wt% to 4.0wt% soil release polymer.

[0015] The composition may comprise from 0.1wt% to 3.0wt% carboxymethylcellulose (CMC).

[0016] The composition may comprise from 0.1wt% to 5.0wt% calcite.

[0017] The composition may comprise from 1wt% to 10wt% carboxylate polymer.

[0018] The composition may comprise less than 10wt% total level of silicates and aluminosilicates.

[0019] The composition may comprise from 0.001wt% to 0.5wt% hueing dye.

[0020] The composition may comprise from 0.001wt% to 0.5wt% organic pigment and/or inorganic pigment.

[0021] The composition may comprise from 0.2 wt% to 10wt% chelant, preferably phosphonate chelant.

[0022] The composition preferably comprises from 10wt% to 40wt% sodium carbonate.

[0023] **Detersive surfactant:** A suitable detersive surfactant system typically comprises at least 5% alcohol ether carboxylate as a percentage of the total detersive surfactant system.

[0024] A suitable detersive surfactant system typically comprises at least 5% alcohol ethoxylate having an average degree of ethoxylation in the range of from 10 to 50 as a percentage of the total detersive surfactant system.

[0025] Preferably, the detersive surfactant comprises C_8-C_{24} alkyl ethoxylated alcohol having an average degree of ethoxylation of from 20 to 50, and preferably the compositon comprises from 1wt% to 10wt% C_8-C_{24} alkyl ethoxylated alcohol having an average degree of ethoxylation of from 20 to 50. A suitable highly ethoxylated alcohol is Lutensol® AO30 from BASF and/or Slovasol® 2430 from Sasol.

[0026] **Anionic detersive surfactant:** Suitable anionic detersive surfactants include sulphonate and sulphate detersive surfactants.

[0027] Suitable sulphonate detersive surfactants include methyl ester sulphonates, alpha olefin sulphonates, alkyl benzene sulphonates, especially alkyl benzene sulphonates, preferably C_{10-13} alkyl benzene sulphonate. Suitable alkyl benzene sulphonate (LAS) is obtainable, preferably obtained, by sulphonating commercially available linear alkyl benzene (LAB); suitable LAB includes low 2-phenyl LAB, other suitable LAB include high 2-phenyl LAB, such as those supplied by Sasol under the tradename Hyblene®.

[0028] Suitable sulphate detersive surfactants include alkyl sulphate, preferably C_{8-18} alkyl sulphate, or predominantly C_{12} alkyl sulphate.

[0029] A preferred sulphate detersive surfactant is alkyl alkoxylated sulphate, preferably alkyl ethoxylated sulphate,

preferably a C_{8-18} alkyl alkoxylated sulphate, preferably a C_{8-18} alkyl ethoxylated sulphate, preferably the alkyl alkoxylated sulphate has an average degree of alkoxylation of from 0.5 to 20, preferably from 0.5 to 10, preferably the alkyl alkoxylated sulphate is a C_{8-18} alkyl ethoxylated sulphate having an average degree of ethoxylation of from 0.5 to 10, preferably from 0.5 to 5, more preferably from 0.5 to 3 and most preferably from 0.5 to 1.5.

[0030] The alkyl sulphate, alkyl alkoxylated sulphate and alkyl benzene sulphonates may be linear or branched, substituted or un-substituted, and may be derived from petrochemical material or biomaterial.

[0031] Other suitable anionic detersive surfactants include alkyl ether carboxylates.

[0032] Suitable anionic detersive surfactants may be in salt form, suitable counter-ions include sodium, calcium, magnesium, amino alcohols, and any combination thereof. A preferred counterion is sodium.

Alkyl ether carboxylic acid: A suitable alkyl ether carboxylic acid has the following structure:

$$R\text{-}(OCH_2CH_2)n\text{-}OCH_2\text{-}COOH$$

wherein,

R is selected from saturated and mono-unsaturated C_{10} to C_{26} linear or branched alkyl chains, preferably C_{12} to C_{24} linear or branched alkyl chains, most preferably a C_{16} to C_{20} linear alkyl chain;

n is selected from 5 to 20, preferably 7 to 13, more preferably 8 to 12, most preferably 9.5 to 10.5; and

[0033] The alkyl ether carboxylic acid may be present from 0.5 to 20 wt%, preferably from 2 to 14 wt%, most preferably from 2.5 to 5 wt%. It may be present in acid or salt form, most preferably as its sodium salt.

[0034] Suitable materials are sold under the AKYPO® (Kao) and Empicol® C (Huntsman) brand names.

[0035] **Non-ionic detersive surfactant:** Suitable non-ionic detersive surfactants are selected from the group consisting of: C_8-C_{18} alkyl ethoxylates, such as, NEODOL® non-ionic surfactants from Shell; C_6-C_{12} alkyl phenol alkoxylates wherein preferably the alkoxylate units are ethyleneoxy units, propyleneoxy units or a mixture thereof; C_{12}-C_{18} alcohol and C_6-C_{12} alkyl phenol condensates with ethylene oxide/propylene oxide block polymers such as Pluronic® from BASF; alkylpolysaccharides, preferably alkylpolyglycosides; methyl ester ethoxylates; polyhydroxy fatty acid amides; ether capped poly(oxyalkylated) alcohol surfactants; and mixtures thereof.

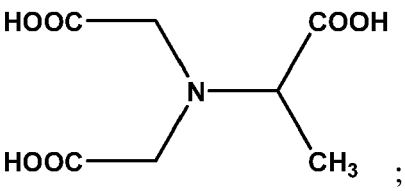
[0036] Suitable non-ionic detersive surfactants are alkylpolyglucoside and/or an alkyl alkoxylated alcohol.

[0037] Suitable non-ionic detersive surfactants include alkyl alkoxylated alcohols, preferably C_{8-18} alkyl alkoxylated alcohol, preferably a C_{8-18} alkyl ethoxylated alcohol, preferably the alkyl alkoxylated alcohol has an average degree of alkoxylation of from 1 to 50, preferably from 1 to 30, or from 1 to 20, or from 1 to 10, preferably the alkyl alkoxylated alcohol is a C_{8-18} alkyl ethoxylated alcohol having an average degree of ethoxylation of from 1 to 10, preferably from 1 to 7, more preferably from 1 to 5 and most preferably from 3 to 7. The alkyl alkoxylated alcohol can be linear or branched, and substituted or un-substituted.

[0038] Suitable nonionic detersive surfactants include secondary alcohol-based detersive surfactants.

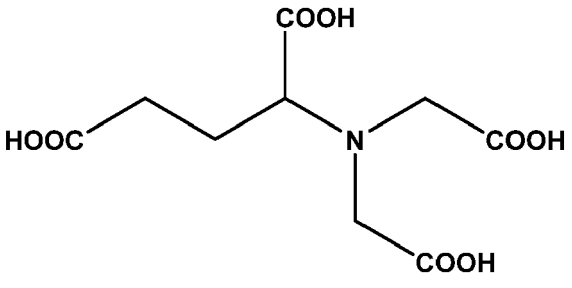
[0039] **Amino acid derivative complexing agent:** A suitable amino acid derivative complexing agent is selected from one or more of the following, in any stereoisomer or mixture of stereoisomer form:

(i) methylglycinediacetic acid and salts thereof (MGDA)



;

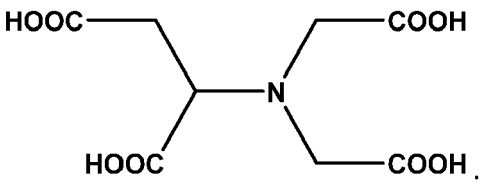
(ii) L-glutamic acid, N,N-diacetic acid and salts thereof (GLDA)



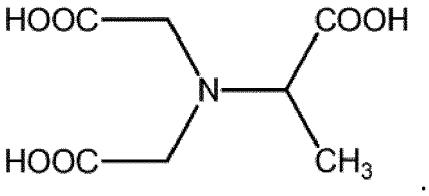
;

and

(iii) L-aspartic acid N,N-diacetic acid and salts thereof (ASDA)



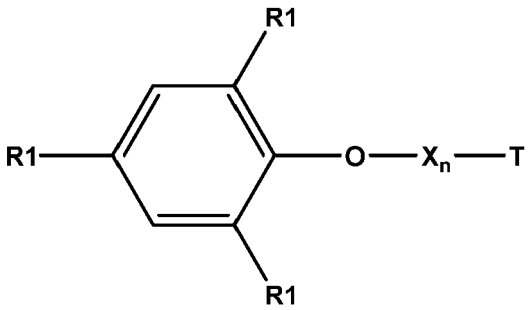
[0040] Preferbly, the composition comprises from 0.1wt% to 10wt% methylglycinediacetic acid and salts thereof (MGDA)



[0041] It may be preferred to formulate the amino acid derivative complexing agent in acid form. Alternatively, it may be preferred to formulate the amino acid derivative complexing agent in salt form, especially preferred is the sodium salt form.

[0042] Suitable MGDA salts are produced by BASF. Suitable GLDA salts are produced by Akzo Nobel and Showa Denko. Suitable ASDA salts are produced by Mitsubishi Rayon.

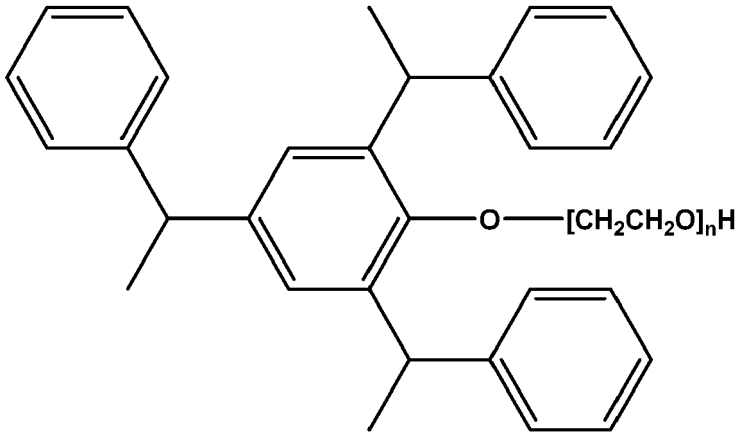
[0043] **Alkoxylated polyaryl/polyalkyl phenol:** A suitable alkoxylated polyaryl/polyalkyl phenol has the following structure:



wherein R_1 is selected from linear of branched C_3-C_{15} alkyl groups and aryl groups, X is selected from ethoxy or propoxy groups, n is from 2 to 70, T is selected from H, SO_3^-, COO^- and PO_3^{2-}

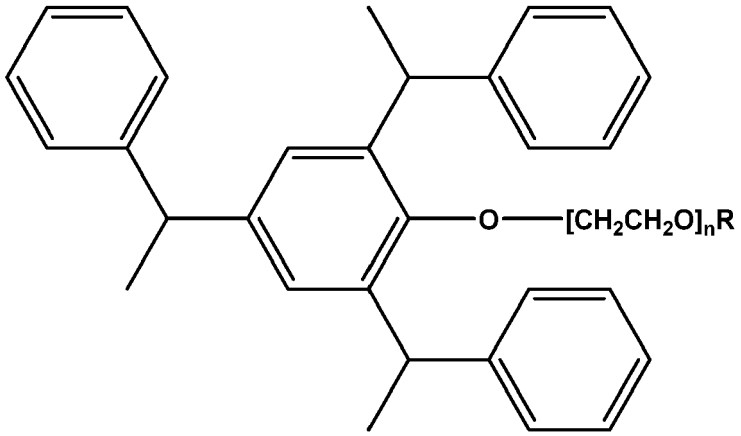
[0044] The alkoxylated polyaryl or alkoxylated polyalkyl phenol is preferably selected from groups (i) to (iv):

(i) Uncharged alkoxylated tristyrylphenols of the following structure:



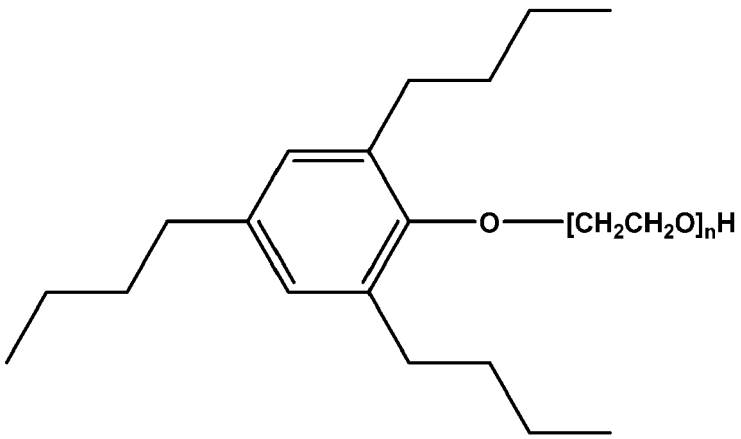
wherein n is selected from 2 to 70, more preferably n is selected from 10 to 54, most preferably n = 16 or 20.

(ii) Anionic alkoxylated tristyrylphenols of the following structure



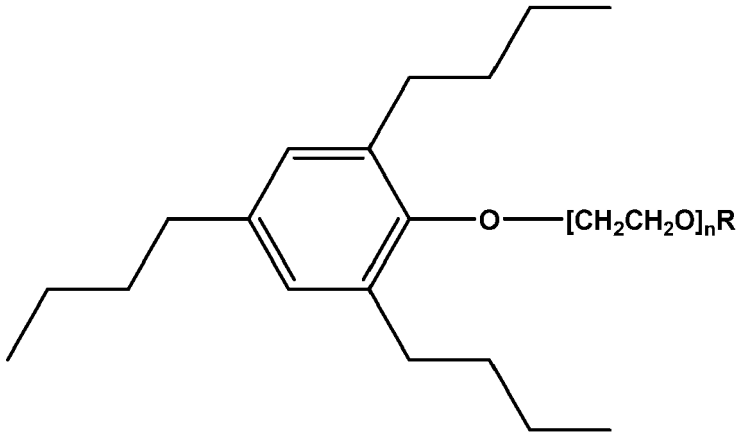
wherein R is selected from SO_3^-, COO^- and PO_3^{2-}, preferably selected from SO_3^- and COO^-, wherein n is selected from 2 to 54.

(iii) Uncharged alkoxylated tri(n-butyl)phenols of the following structure:



wherein n is selected from 2 to 50

(iv) Anionic alkoxylated tri(n-butyl)phenols of the following structure:



wherein R is selected from SO_3^-, COO^- and PO_3^{2-}, preferably selected from $SO3^-$ and COO^-, wherein n is selected from 6 to 50.

[0045] Such compounds are available from industrial suppliers, for example Solvay under the Soprophor trade name, from Clariant under the Emulsogen trade name, Aoki Oil Industrial Co. under the Blaunon trade name, from Stepan under the Makon trade name, and from TOTO Chemical Industry Co. under the Sorpol trade name. Specific examples of suitable compounds are Emulsogen® TS160, Hostapal® BV conc., Sapogenat® T110 or Sapogenat® T139, all from Clariant.

[0046] The alkoxylated polyaryl/polyalkyl phenol may be present at levels of 0.5-20wt%, preferably 1-15wt%, most preferably 3-10wt%.

[0047] **Amylase variant:** A suitable amylase variant comprises:

(a) a deletion and/or a substitution at two or more positions corresponding to positions R181, G182, H183 and G184 of the mature polypeptide of SEQ ID NO: 1 , and

(b) a substitution at one or more positions said substitutions selected from the group consisting of:

I206Y;F;Q;P;R;V;C;G;A;C;D;E;H;K;L;M;N;S;T, particularly I206Y;F;C;L;H;S,
N195F;Y;H;K;L,
L63Q;P;R;V;F;C;G;A;C;D;E;H;K;I;M;N;S;T;Y, particularly L63V,
A113M;R;W;I;L,
M116F;Y;I;W;L,
R118P;Q;V;F;C;G;A;C;D;E;H;I;K;L;M;N;S;T;Y, particularly R118P;Q;V;F;C;G,
N128C;
Q129P;R;V;F;C;G;A;C;D;E;H;I;K;L;M;N;S;T;Y, particularly Q129E,
G133N,
A139Q;P;R;V;F;C;G;C;D;E;H;I;K;L;M;N;S;T;Y, particularly A139T,
R142H;V;L;Q;I,
A186E;N;Q;S,
E190P;R;V;F;C;G;A;C;D;Q;H;I;K;L;M;N;S;T;Y, particularly E190P,
A204Q;P;R;V;F;C;G;C;D;E;H;I;K;L;M;N;S;T;Y, particularly A204T,
H210M;D;C;A;Q;S;F;N;E;T,
P211Q;R;V;F;C;G;A;C;D;E;H;1;K;L;M;N;S;T;Y,particularly P211L;M;S;Q;G;V;W;A;H;T;R;
E212T;R;S;V;L;Y;R;T;G;
V213Q;P;R;F;C;G;A;C;D;E;H;I;K;L;M;N;S;T;Y, particularly V213T;A;G;S;C;L;P,
V214Q;P;R;F;C;G;A;C;D;E;H;I;K;L;M;N;S;T;Y, particularly V214T;I,
L217M;Q;V;I;H, particularly L217V,
Y243Q;P;R;F;C;G;A;C;D;E;H;I;K;L;M;N;S;T;V, particularly Y243F,
S244Q;P;R;F;C;G;A;C;D;E;H;I;K;L;M;N;Y;T;V, particularly S244Q,
T246Q;P;R;F;C;G;A;C;D;E;H;I;K;L;M;N;Y;S;V, particularly T246Q;M,
N260E, Q280S, N311R, F343W, D418C, S419M, S420Q;R and Y482W,

where the positions correspond to the positions of SEQ ID NO 1 and wherein the amylase variant has at least 95%, such as at least 96%, or at least 97%, or at least 98%, or at least 99% but less than 100% sequence identity to the

polypeptide having the amino acid sequence of SEQ ID NO: 1 and wherein the variant has alpha-amylase activity.

[0048] One preferred amylase variant comprises a sequence corresponding to SEQ ID NO: 1 with the following mutations: H183*+G184*+I405L+A421H+A422P+A428T.

[0049] A suitable amylase is commercially available from Novozymes under the Amplify® brand name, for example as a liquid raw material as Amplify® 12L.

[0050] **Metalloprotease:** Metalloproteases can be derived from animals, plants, bacteria or fungi. Suitable metalloprotease can be selected from the group of neutral metalloproteases and *Myxobacter* metalloproteases. Suitable metalloproteases can include collagenases, hemorrhagic toxins from snake venoms and thermolysin from bacteria.

[0051] Preferred thermolysin enzyme variants include an M4 peptidase, more preferably the thermolysin enzyme variant is a member of the PepSY~Peptidase_M4~Peptidase_M4_C family.

[0052] Suitable metalloprotease variants can have at least 50% identity to the thermolysin set forth in SEQ ID NO: 3. In some embodiments, the thermolysin enzyme variant is from a genus selected from the group consisting of *Bacillus, Geobacillus, Alicyclobacillus, Lactobacillus, Exiguobacterium, Brevibacillus, Paenibacillus, Herpetosiphon, Oceanobacillus, Shewanella, Clostridium, Staphylococcus,Flavobacterium, Stigmatella, Myxococcus, Vibrio, Methanosarcina, Chryseobacterium, Streptomyces,Kribbella, Janibacter, Nocardioides, Xanthamonas, Micromonospora, Burkholderia, Dehalococcoides,Croceibacter, Kordia, Microscilla, Thermoactinomyces, Chloroflexus, Listeria, Plesiocystis,Haliscomenobacter, Cytophaga, Hahella, Arthrobacter, Brachybacterium, Clavibacter, Microbacterium,Intrasporangium, Frankia, Meiothermus, Pseudomonas, Ricinus, Catenulispora, Anabaena, Nostoc, Halomonas, Chromohalobacter, Bordetella, Variovorax, Dickeya, Pectobacterium, Citrobacter,Enterobacter, Salmonella, Erwinia, Pantoea, Rahnella, Serratia, Geodermatophilus, Gemmata,Xenorhabdus, Photorhabdus, Aspergillus, Neosartorya, Pyrenophora, Saccharopolyspora, Nectria,Gibberella, Metarhizium, Waddlia, Cyanothece, Cellulphaga, Providencia, Bradyrhizobium,Agrobacterium, Mucilaginibacter, Serratia, Sorangium, Streptosporangium, Renibacterium, Aeromonas,Reinekea, Chromobacterium, Moritella, Haliangium, Kangiella, Marinomonas, Vibrionales, Listonella, Salinivibrio, Photobacterium, Alteromonadales, Legionella, Teredinibacter, Reinekea, Hydrogenivirga and Pseudoalteromonas.* In some embodiments, the thermolysin enzyme variant is from a genus selected from the group consisting of *Bacillus, Geobacillus, Alicyclobacillus, Lactobacillus, Exiguobacterium, Brevibacillus, Paenibacillus, Herpetosiphon, Oceanobacillus, Shewanella, Clostridium, Staphylococcus, Flavobacterium, Stigmatella, Myxococcus, Vibrio, Methanosarcina, Chryseobacterium, and Pseudoalteromonas.*

[0053] Preferably the thermolysin enzyme is from the genus *Bacillus.*

[0054] Preferred metalloproteases include thermolysin, matrix metalloproteinases and those metalloproteases derived from *Bacillus subtilis, Bacillus thermoproteolyticus, Geobacillus stearothermophilus* or *Geobacillus sp.,* or Bacillus amyloliquefaciens, as described in US PA 2008/0293610A1.

[0055] A specially preferred metalloprotease belongs to the family EC3.4.24.27.

[0056] Further suitable metalloproteases are the thermolysin variants described in WO2014/71410.

[0057] In one aspect the metalloprotease is a variant of a parent protease, said parent protease having at least 60%, or 80%, or 85% or 90% or 95% or 96% or 97% or 98% or 99% or even 100% identity to SEQ ID NO:3 including those with substitutions at one or more of the following sets of positions versus SEQ ID NO:3:

(a) 2, 26, 47, 53, 87, 91,96, 108, 118, 154, 179, 197, 198, 199, 209, 211, 217, 219, 225, 232, 256, 257, 259, 261, 265, 267, 272,276, 277, 286, 289, 290, 293, 295, 298, 299, 300, 301, 303, 305, 308, 311 and 316;
(b) 1, 4, 17, 25, 40, 45, 56, 58, 61, 74, 86, 97, 101, 109, 149, 150 , 158, 159, 172, 181, 214, 216, 218, 221, 222, 224, 250, 253, 254, 258, 263, 264, 266, 268, 271, 273, 275, 278, 279, 280, 282, 283, 287, 288, 291, 297, 302, 304, 307 and 312;
(c) 5, 9, 11, 19, 27, 31, 33, 37, 46, 64, 73, 76, 79, 80, 85, 89, 95, 98, 99, 107, 127, 129, 131, 137, 141, 145, 148, 151, 152, 155, 156, 160, 161, 164, 168 , 171, 176, 180, 182, 187, 188, 205, 206, 207, 210, 212, 213, 220, 227, 234 , 235, 236, 237, 242, 244, 246, 248, 249, 252, 255, 270, 274, 284, 294, 296, 306, 309, 310, 313, 314 and 315;
(d) 3, 6, 7, 20, 23, 24, 44, 48, 50, 57, 63, 72, 75, 81, 92, 93, 94, 100, 102, 103, 104, 110, 117, 120, 134, 135, 136, 140, 144, 153, 173, 174, 175, 178, 183, 185, 189, 193, 201, 223, 230, 238, 239, 241, 247, 251, 260, 262, 269, and 285;
(e) 17, 19, 24, 25, 31, 33, 40, 48, 73, 79, 80, 81, 85, 86, 89, 94, 109, 117, 140, 141, 150, 152, 153, 158, 159, 160, 161, 168, 171, 174, 175, 176, 178, 180, 181, 182, 183, 189, 205, 206, 207, 210, 212, 213, 214, 218, 223, 224,227, 235, 236, 237, 238, 239, 241, 244, 246, 248, 249, 250, 251, 252, 253, 254, 255, 258, 259, 260, 261, 262, 266, 268, 269, 270, 271, 272, 273, 274, 276, 278, 279, 280, 282, 283, 294, 295, 296, 297, 300, 302, 306, 310 and 312;
(f) 1, 2, 127, 128, 180, 181, 195, 196, 197, 198, 199, 211, 223, 224, 298, 299, 300, and 316 all relative to SEQ ID NO:3.

[0058] In a further aspect the metalloprotease protease is a variant of a parent protease, said parent protease having at least 60%, or 80%, or 85% or 90% or 95% or 96% or 97% or 98% or 99% or even 100% identity to SEQ ID NO:3 including those with substitutions at one or more of the following sets of positions versus SEQ ID NO:3:

(a) I001L, T002A, T002C, T002I, T002K, T002M, T004K, T004L, T004M, T004Y, Q017L, N037K, F040K, F040L,

K045A, K045G, K045M, T049E, T049M, T049Y, L050P, S053C, S053L, A056M, A058E, A058L, Q061L, F063C, A064D, A064E, S065A, S065D, S065E, S065P, S065Y, V087C, V087K, V087L, V087M, V087N, V087Q, V087W, V087Y, N096K, N096L, N096Y, R101H, Q108L, Q108M, G109E, G109M, G109R, G109W, S118A, S118D, S118M, S118Q, S118R, S118T, SI 18V, Q128A, Q128L, Q128Y, I131L, I137L, T149N, G154A, G154H, G154K, G154M, G154Y, L155M, I164A, N181S, G196A, G196W, I197C, S198A, S198K, G199A, G199Y, A209C, A209M, H216A, Y217C, Y217L, T222K, N227A, I244L, Q246D, V256N, L263A, L263M, T272K, Q273N, Y274M, P277A, P277D, P277Y, L284A, L284M, L284Y, A286K, A286L, A286M, A286N, A286Y, A287C, A288L, A288M, V289A, S291A, S291T, T293A, T293I, T293K, T293L, T293M, T293Y, L295A, L295K, L295M, L295W, Y296M, G297N, S298A, S298G, S298K, S298M, S298R, T299A, T299K, S300D, S300N, Q301K, E302A, V303A, V303P, V303Y, A304E, A304K, A304Y, S305A, S305K, S305M, V306L, V306T, A309C, F310M, D311A, D311K, D311L, D311M, D311V, D311W,D311Y, and A312C;

(b) T002Q, T004V, V007I, V009I, R01 IK, I020L, I020V, S025A, S025C, S025K, S025M, S025R, T026C, T026D, Y027C, Y027L, N037L, F040A, A044C, K045F, K045H, K045Q, K045Y, Y046C, R047D, R047E, R047G, R047L, R047M, R047Q, R047T, T049L, T049N, T049Q, T049V, S053A, S053N, S053V, A056E, Q061C, Q061I, A064T, S065L, S065T, S065W, A073F, A073L, A073M, A073W, H074C, H074F, H074M, H074N, H074Q, H074W, T080L, T080N, K085S, N086D, V087R, V087T, L091A, L091N, L091R, L091W, L091Y, S092L, Y093C, N096G, N096H, N096Q, N096R, N096S, N096W, N097E, N097M, A099R, A099S, R101C, R101L, R101S, S102N, S107G, Q108I, Q108K, Q108N, G109S, S118E, M120L, Q128I, Q128K, T129L, T129M, I131W, S134P, G136S, I137E, I137T, I137V, V140D, V148A, V148Q, T149D, T149S, T152G, G154C, G154N, L155I, N159S, N159Y, I164C, I168L, I171G, Y179F, A180S, G189A, Y193F, G196H, G196L, G196Y, I197F, S198M, S198N, S198R, S198W, S201A, A209G, A209I, A209K, A209P, A209R, A209Y, Y211E, Y211R, P214A, P214R, Y217A, Y217F, Y217M, Y217N, K219A, K219E, K219R, K219S, R220A, Y221A, Y221F, Y221G, Y221M, T222A, T222M, Q225C, Q225E, Q225K, Q225L, Q225S, I232L, I232R, I232S, I232T, I232V, I232Y, S234A, S234C, G235A, I236C, I244A, I244M, Q246C, V256S, G257K, G257R, I258A, I258C, I258K, I258Q, I258V, G259N, G259S, G259T, L263H, L263K, L263N, L263V, G264A, G264N, G264P, G264Q, G264S, G264T, K265N, I266C, I266M, I266T, I266V, F267A, F267C, F267H, F267I, F267K, F267L, F267M, F267T, F267Y, R269K, A270G, L271H, T272A, Q273E, Q273G, L275C, L275Q, L275S, L275T, T276A, T276L, T276V, T276Y, P277E, P277F, P277G, P277H, P277N, P277R, P277V, P277W, S279G, R285Y, A286C, A286Q, A286R, A286T, A288N, V289L, V289M, V289Y, Q290A, Q290H, Q290N, S291V, T293N, T293V, T293W, D294N, L295F, L295G, Y296W, G297D, S298E, S298N, S298P, T299N, S300A, S300G, S300T, Q301M, Q301S, Q301T, Q301V, E302D, E302Q, V303G, V303K, V303L, V303R, V303W, A304R, A304S, A304T, A304W, S305H, S305T, S305V, V306I, Q308A, Q308L, F310C, F310W, D311F, D311G, D311I, D311Q, D311S, D311T, V313C, G314Q, V315L, V315T, K316A, and K316M;

(c) I001K, I001M, I001V, T002F, T002L, T002P, T002S, T002V, T002W, T002Y, T004E,S005D, S005N, S005P, T006C, RO11I, Q017I, Q017W, Q017Y, S025D, S025F, T026K, T026L, T026R,T026V, T026Y, Y027W, Q031A, Q031K, Q031V, N033S, N033T, N037D, N037Q, N037R, F040E, F040G, F040M, F040Q, F040S, F040Y, K045E, K045L, K045S, Y046L, R047A, R047C, R047H, R047K, R047N, T048E, T049A, T049D, T049F, T049H, T049I, T049S, S053F, S053H, S053I, S053M, S053Q, S053T, S053W, A056K, A056Q, A056V, A056W, Q061M, S065I, S065M, S065Q, S065V, D072F, H074E, H074L, Y076H, Y076L, Y076M, Y076Q, V079L, V079Q, V079T, T080I, Y081F, K085E, N086L, N086S, V087D, V087E, V087G, V087I, V087S, L091D, L091E, L091F, L091K, L091M, L091P, L091Q, L091S, Y093T, G095A, G095D, G095H, G095M, G095N, G095S, N096C, N096D, N096I, N096V, N097K, A098C, A098E, A098H, A098R, A099E, A099K, A099P, S107D, Q108C, Q108E, Q108F, Q108H, G127C, G127D, G127E, Q128C, Q128D, Q128E, Q128R, Q128S, T129I, T129R, S134A, I137P, A141S, T145A, T145C, T145E, T145G, T145M, T145N, T145Q, V148L, V148N, V148Y, T149M, T149V, Y151K, T152S, A153T, G154L, G154Q, G154S, G154T, L155C, Q158A, Q158K, Q158M, Q158N, N159R, N159W, S161A, S161N, S161P, S161T, I164L, I164N, I164S, I164T, I164V, I171C, I171E, I171F, I171L, I171S, F172G, F172L, F172M, F172Q, F172S, F172V, F172W, F172Y, G173A, G173C, T174C, V176L, V176N, N181L, G196D, G196E, G196T, I197D, I197K, I197L, I197T, I197V, I197W, I197Y, S198C, S198E, S198F, S198G, S198H, S198I, S198P, S198Q, S198T, S198V, G199C, G199E, G199F, G199H, G199Q, G199S, G199T, G199W, M205L, A209D, A209E, A209L, A209S, A209T, A209V, Y211A, Y211C, Y211D, Y211F, Y211G, Y211H, Y211I, Y211L, Y211N, Y211Q, Y211S, Y211T, D213N, D213S, P214C, P214G, P214K, P214S, H216C, H216E, H216S, H216T, Y217Q, Y217S, Y217T, Y217V, Y217W, S218K, S218L, S218Y, K219D, K219F, K219G, K219H, K219I, K219M, K219N, K219Q, K219T, R220K, R220V, Y221K, Y221N, Y221Q, Y221R, Y221S, Y221T, Y221V, T222C, T222D, T222L, T222Y, T224K, T224M, Q225D, Q225G, Q225H, Q225I, Q225P, Q225V, Q225W, I232C, I232E, I232F, I232K, I232M,I232N, I232Q, I232W, S234D, G235M, I236M, Y242C, Y242F, Y242N, Y242V, I244T, I244V, Q246E, Q246N, Q246T, G247A, G247S, T249K, T249M, T249N, H250A, H250C, G252K, G252Y, V253N, V253T, S254A, S254M, S254R, S254Y, V255L, V255P, V256L, V256T, G257C, G257D, G257E, G257L, G257N, G257P, G257Q, G257S, G257T, G257Y, I258E, I258L, I258M, I258N, G259A, G259C, G259E, G259F, G259H, G259L, G259M, G259W, D261A, D261N, L263C, L263I, L263Q, L263T, K265A, K265C, K265D, K265M, K265P, K265Q, K265S, I266A, I266F, I266L, I266S, F267E, F267G,

F267N, F267S, F267V, F267W, Y268M, Y268Q, Y268V, A270C, A270F, A270I, A270L, A270S, L271A, L271D, L271F, L271I, T272E, T272L, T272V, T272W, Q273A, Q273H, Q273Y, Y274F, Y274H, L275I, L275M, L275V, T276C, T276F, T276I, T276P, T276Q, T276W, P277Q, P277S, P277T, T278G, S279A, S279D, S279I, S279L, S279M, S279N, S279Q, S279T, N280A, N280C, N280D, N280E, S282K, S282N, L284V, L284W, R285K, A286D, A286E, A286F, A286G, A286H, A286I, A286S, A287I, A287L, A287N, A287V, A287Y, A288C, A288I, A288S, A288T, A288V, V289C, V289E, V289F, V289G, V289I, V289N, V289S, V289W, Q290C, Q290D, Q290F, Q290G, Q290L, Q290W, S291E, T293C, T293E, T293F, T293G, T293H, T293Q, T293S, L295C, L295I, L295N, Y296N, G297A, G297M, G297R, G297Y, S298C, S298T, S298W, S298Y, T299C, T299F, T299L, T299M, T299R, T299W, S300C, S300K, S300M, S300R, S300Y, Q301E, Q301H, Q301P, Q301R, V303C, V303H, A304C, A304D, A304L, A304N, S305G, S305I, S305L, S305N, S305W, S305Y, V306A, V306S, K307A, K307C, K307G, K307I, K307M, K307N, K307Q, K307R, K307W, K307Y, Q308C, Q308D, Q308F, Q308G, Q308I, Q308M, A309G, A309S, D311C, D311E, A312G, A312M, A312V, V313T, G314A, G314E, G314H, G314M, G314S, G314W, V315A, V315C, V315I, V315M, K316D, K316E, K316F, K316G, K316H, K316L, K316N, K316P, K316Q, K316R, K316S, K316V, K316W and K316Y.

[0059] Further suitable metalloproteases are the NprE variants described in WO2007/044993, WO2009/058661 and US 2014/0315775.

[0060] In one aspect the protease is a variant of a parent protease, said parent protease having at least 45%, or 60%, or 80%, or 85% or 90% or 95% or 96% or 97% or 98% or 99% or even 100% identity to SEQ ID NO:4 including those with substitutions at one or more of the following sets of positions versus SEQ ID NO:4:

S23, Q45, T59, S66, S129, F130, M138, V190, S199, D220, K211, and G222,

[0061] Another suitable metalloprotease is a variant of a parent protease, said parent protease having at least 60%, or 80%, or 85% or 90% or 95% or 96% or 97% or 98% or 99% or even 100% identity to SEQ ID NO:4 including those with substitutions at one or more of the following sets of positions versus SEQ ID NO:4:

Q45E, T59P, 566E, S129I, S129V, F130L, M138I, V190I, S199E, D220P, D220E, K211V, K214Q, G222C, M138L/D220P, F130L/D220P, S129I/D220P, V190I/D220P, M138L/V190I/D220P, S129I/V190I, S129V/V190I, S129V/D220P, S129I/F130L/D220P, T004V/S023N, T059K/S66Q/S129I, T059R/S66N/S129I, S129I/F130L/M138L/V190I/D220P and T059K/S66Q/S129V.

[0062] Especially preferred metalloproteases for use herein belong belong to EC classes EC 3.4.22 or EC3.4.24, more preferably they belong to EC classes EC3.4.22.2, EC3.4.24.28 or EC3.4.24.27. The most preferred metalloprotease for use herein belong to EC3.4.24.27.

[0063] Suitable commercially available metalloprotease enzymes include those sold under the trade names Neutrase® by Novozymes A/S (Denmark), the Corolase® range including Corolase® 2TS, Corolase® N, Corolase® L10, Corolase® LAP and Corolase® 7089 from AB Enzymes, Protex 14L and Protex 15L from DuPont (Palo Alto, California), those sold as thermolysin from Sigma and the Thermoase range (PC10F and C100) and thermolysin enzyme from Amano enzymes.

[0064] A preferred metalloprotease is selected from the M4 Metalloprotease Family.

[0065] **Lipase:** A suitable lipase is a variant of SEQ ID NO:2 comprising:

(a) substitutions T231R and N233R

and

(b) at least three further substitutions selected from D27R, N33Q, G38A, D96E, D111A, G91Q, G163K, E210Q, D254S, I255A, and P256T;

where the positions correspond to the positions of SEQ ID NO 2 and wherein the lipase variant has at least 95% but less than 100% sequence identity to the polypeptide having the amino acid sequence of SEQ ID NO: 2 and wherein the variant has lipase activity.

[0066] One preferred lipase is a variant of SEQ ID NO: 2 comprising the following substitutions: T231R, N233R, D27R, G38A, D96E, D111A, G163K, D254S and P256T

[0067] One preferred lipase is a variant of SEQ ID NO: 2 comprising the following substitutions: T231R, N233R, N33Q, G91Q, E210Q, I255A.

[0068] Suitable lipases are commercially available from Novozymes, for example as Lipex Evity 100L (a liquid raw material) and Lipex Evity 105T (a granulate). These lipases have different structures to the products Lipex 100L, Lipex

100T and Lipex Evity 100T which are outside the scope of this particular lipase definition.

[0069] **Builder system:** A suitable water-soluble builder system comprising one or more aminocarboxylates, selected from: methylglycine diacetic acid (MGDA) and/or alkali metal or ammonium salts thereof; N,N-dicarboxymethyl glutamic acid (GLDA) and/or alkali metal or ammonium salts thereof; Aspartic acid N,N-diacetic acid (ASDA) and/or alkali metal or ammonium salts thereof; Ethylene diamine-N,N'-disuccunic acid (EDDS) and/or alkali metal or ammonium salt thereof; 2-hydroxy propylene diamine-N,N'-disuccunic acid (HPDDS), and/or alkali metal or ammonium salt thereof; ethylenediamine-N,N'-diglutaric acid (EDDG and/or alkali metal or ammonium salt thereof; ethylenediamine-N,N'-bis-(orthohydroxyphenyl)acetic acid (EDDHA) and/or alkali metal or ammonium salt thereof; N-hydroxyethyl ethylenediamine-N,N',N'-triacetic acid (HEDTA) alkali metal or ammonium salts thereof; iminodisuccinate, hydroxyethyl iminodiacetate, and ethylene iminodisuccinate and the respective alkali metal or ammonium salts; and any combination thereof.

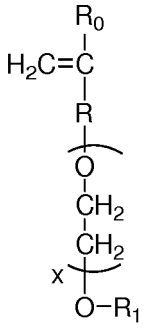
[0070] **Phosphonate chelant:** A suitable phosphonate chelant is selected from: 1-hydroxyethane-1,1-diphosphonic acid (HEDP); Diethylene triamine pentamethylene phosphonic acid (DTPMP, CW-Base); 2-phosphonobutane-1,2,4-tricarboxylic acid (PBTC); Amino trimethylene phosphonic acid (ATMP); Ethylenediamine tetramethylene phosphonic acid (EDTMP); Diethylenetriamine pentamethylene phosphonic acid (DTPMP); Aminotrimethylene phosphonic acid (ATMP); salts of the aforementioned materials; and any combination thereof.

[0071] **Carboxylate polymer:** The composition may comprise a carboxylate polymer, such as a maleate/acrylate random copolymer, maleic-olefin copolymers or polyacrylate homopolymer. Suitable carboxylate polymers include: polyacrylate homopolymers having a molecular weight of from 4,000 Da to 9,000 Da; maleate/acrylate random copolymers having a molecular weight of from 50,000 Da to 100,000 Da, or from 60,000 Da to 80,000 Da. Examples of the foregoing include Acusol 410N, Acusol 445N (polyacrylic acid, Na salt); Acusol 450N and Acusol 480N (modified polyacrylic acid, Na salt); Acusol 479N, Acusol 490N, and Acusol 505N (acrylic acid/maleic acid, Na salt); Acusol 460N (maleic acid/olefin, Na salt); Sokolan CP5 and Sokolan CP12S (maleic acid/acrylic acid, Na salt); and Sokolan CP 9 (maleic acid/olefin, Na salt). The Acusol series are available from Rohm & Haas, Philadelphia, PA and the Sokolan series are available from BASF (Germany and New Jersey).

[0072] Suitable carboxylate polymers can contain other monomers including modified acrylic, fumaric, maleic, itaconic, aconitic, mesaconic, citraconic and methylenemalonic acid or their salts, modified maleic anhydride, acrylamide, alkylene, vinylmethyl ether, styrene and any mixtures thereof. Suitable carboxylate polymers can also containing 2-acrylamido-2-methyl-1-propanesulfonic acid, 2-methacrylamido-2-methyl-1-propanesulfonic acid, 3-methacrylamido-2-hydroxypropanesulfonic acid, allysulfonic acid, methallysulfonic acid, 2-hydroxy-3-(2-propenyloxy)propanesulfonic acid, 2-methyl-2-propenen-1-sulfonic acid, styrenesulfonic acid, vinylsulfonic acid, 3-sulfopropyl acrylate, 3-sulfopropylmethacrylate, sulfomethylacrylamide, sulfomethylmethacrylamide and water soluble salts thereof.

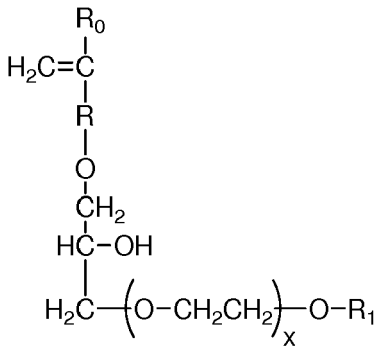
[0073] Another suitable carboxylate polymer is a co-polymer that comprises: (i) from 50 to less than 98 wt% structural units derived from one or more monomers comprising carboxyl groups; (ii) from 1 to less than 49 wt% structural units derived from one or more monomers comprising sulfonate moieties; and (iii) from 1 to 49 wt% structural units derived from one or more types of monomers selected from ether bond-containing monomers represented by formulas (I) and (II):

formula (I):



wherein in formula (I), R_0 represents a hydrogen atom or CH_3 group, R represents a CH_2 group, CH_2CH_2 group or single bond, X represents a number 0-5 provided X represents a number 1-5 when R is a single bond, and R_1 is a hydrogen atom or C_1 to C_{20} organic group;

formula (II)



wherein in formula (II), R_0 represents a hydrogen atom or CH_3 group, R represents a CH_2 group, CH_2CH_2 group or single bond, X represents a number 0-5, and R_1 is a hydrogen atom or C_1 to C_{20} organic group.
It may be preferred that the polymer has a weight average molecular weight of at least 50kDa, or even at least 70kDa.

[0074] Soil release polymer: The composition may comprise a soil release polymer. A suitable soil release polymer has a structure as defined by one of the following structures (I), (II) or (III):

(I) $-[(OCHR^1\text{-}CHR^2)_a\text{-}O\text{-}OC\text{-}Ar\text{-}CO\text{-}]_d$

(II) $-[(OCHR^3\text{-}CHR^4)_b\text{-}O\text{-}OC\text{-}sAr\text{-}CO\text{-}]_e$

(III) $-[(OCHR^5\text{-}CHR^6)_c\text{-}OR^7]_f$

wherein:

a, b and c are from 1 to 200;
d, e and f are from 1 to 50;
Ar is a 1,4-substituted phenylene;
sAr is 1,3-substituted phenylene substituted in position 5 with SO_3Me;
Me is Li, K, Mg/2, Ca/2, Al/3, ammonium, mono-, di-, tri-, or tetraalkylammonium wherein the alkyl groups are C_1-C_{18} alkyl or C_2-C_{10} hydroxyalkyl, or mixtures thereof;
R^1, R^2, R^3, R^4, R^5 and R^6 are independently selected from H or C_1-C_{18}n- or iso-alkyl; and
R^7 is a linear or branched C_1-C_{18} alkyl, or a linear or branched C_2-C_{30} alkenyl, or a cycloalkyl group with 5 to 9 carbon atoms, or a C_8-C_{30} aryl group, or a C_6-C_{30} arylalkyl group.

Suitable soil release polymers are sold by Clariant under the TexCare® series of polymers, e.g. TexCare® SRN240 and TexCare® SRA300. Other suitable soil release polymers are sold by Solvay under the Repel-o-Tex® series of polymers, e.g. Repel-o-Tex® SF2 and Repel-o-Tex® Crystal.

[0075] Anti-redeposition polymer: Suitable anti-redeposition polymers include polyethylene glycol polymers and/or polyethyleneimine polymers.

[0076] Suitable polyethylene glycol polymers include random graft co-polymers comprising: (i) hydrophilic backbone comprising polyethylene glycol; and (ii) hydrophobic side chain(s) selected from the group consisting of: C_4-C_{25} alkyl group, polypropylene, polybutylene, vinyl ester of a saturated C_1-C_6 mono-carboxylic acid, C_1-C_6 alkyl ester of acrylic or methacrylic acid, and mixtures thereof. Suitable polyethylene glycol polymers have a polyethylene glycol backbone with random grafted polyvinyl acetate side chains. The average molecular weight of the polyethylene glycol backbone can be in the range of from 2,000 Da to 20,000 Da, or from 4,000 Da to 8,000 Da. The molecular weight ratio of the polyethylene glycol backbone to the polyvinyl acetate side chains can be in the range of from 1:1 to 1:5, or from 1:1.2 to 1:2. The average number of graft sites per ethylene oxide units can be less than 1, or less than 0.8, the average number of graft sites per ethylene oxide units can be in the range of from 0.5 to 0.9, or the average number of graft sites per ethylene oxide units can be in the range of from 0.1 to 0.5, or from 0.2 to 0.4. A suitable polyethylene glycol polymer is Sokalan HP22. Suitable polyethylene glycol polymers are described in WO08/007320.

[0077] Cellulosic polymer: Suitable cellulosic polymers are selected from alkyl cellulose, alkyl alkoxyalkyl cellulose, carboxyalkyl cellulose, alkyl carboxyalkyl cellulose, sulphoalkyl cellulose, more preferably selected from carboxymethyl

cellulose, methyl cellulose, methyl hydroxyethyl cellulose, methyl carboxymethyl cellulose, and mixures thereof.

[0078] Suitable carboxymethyl celluloses have a degree of carboxymethyl substitution from 0.5 to 0.9 and a molecular weight from 100,000 Da to 300,000 Da.

Suitable carboxymethyl celluloses have a degree of substitution greater than 0.65 and a degree of blockiness greater than 0.45, e.g. as described in WO09/154933.

[0079] **Care polymers:** Suitable care polymers include cellulosic polymers that are cationically modified and/or hydrophobically modified. Such modified cellulosic polymers can provide anti-abrasion benefits and dye lock benefits to fabric during the laundering cycle. Suitable cellulosic polymers include cationically modified hydroxyethyl cellulose. Suitable care polymers also include guar polymers that are cationically and/or hydrophobically modified. Other suitable care polymers include dye lock polymers, for example the condensation oligomer produced by the condensation of imidazole and epichlorhydrin, preferably in ratio of 1:4:1. A suitable commercially available dye lock polymer is Polyquart® FDI (Cognis).

[0080] Other suitable care polymers include amino-silicone, which can provide fabric feel benefits and fabric shape retention benefits.

[0081] **Alkoxylated polyalkyleneimine:** The composition may comprise an alkoxylated polyalkyleneimine, wherein said alkoxylated polyalkyleneimine has a polyalkyleneimine core with one or more side chains bonded to at least one nitrogen atom in the polyalkyleneimine core, wherein said alkoxylated polyalkyleneimine has an empirical formula (I) of $(PEI)_a$-$(EO)_b$-R_1, wherein a is the average number-average molecular weight (MW_{PEI}) of the polyalkyleneimine core of the alkoxylated polyalkyleneimine and is in the range of from 100 to 100,000 Daltons, wherein b is the average degree of ethoxylation in said one or more side chains of the alkoxylated polyalkyleneimine and is in the range of from 5 to 40, and wherein R_1 is independently selected from the group consisting of hydrogen, C_1-C_4 alkyls, and combinations thereof.

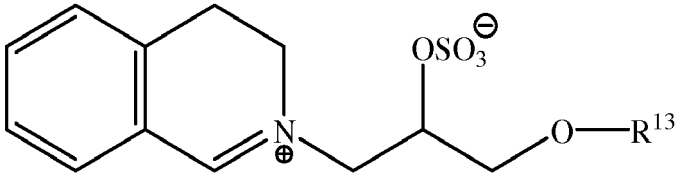
[0082] The composition may comprise an alkoxylated polyalkyleneimine, wherein said alkoxylated polyalkyleneimine has a polyalkyleneimine core with one or more side chains bonded to at least one nitrogen atom in the polyalkyleneimine core, wherein the alkoxylated polyalkyleneimine has an empirical formula (II) of $(PEI)_o$-$(EO)_m(PO)_n$-R_2 or $(PEI)_o$-$(PO)_n(EO)_m$-R_2, wherein o is the average number-average molecular weight (MW_{PEI}) of the polyalkyleneimine core of the alkoxylated polyalkyleneimine and is in the range of from 100 to 100,000 Daltons, wherein *m* is the average degree of ethoxylation in said one or more side chains of the alkoxylated polyalkyleneimine which ranges from 10 to 50, wherein *n* is the average degree of propoxylation in said one or more side chains of the alkoxylated polyalkyleneimine which ranges from 1 to 50, and wherein R_2 is independently selected from the group consisting of hydrogen, C_1-C_4 alkyls, and combinations thereof.

[0083] **Bleach:** Suitable bleach includes sources of hydrogen peroxide, bleach activators, bleach catalysts, pre-formed peracids and any combination thereof. A particularly suitable bleach includes a combination of a source of hydrogen peroxide with a bleach activator and/or a bleach catalyst.

[0084] **Source of hydrogen peroxide:** Suitable sources of hydrogen peroxide include sodium perborate and/or sodium percarbonate.

[0085] **Bleach activator:** Suitable bleach activators include tetra acetyl ethylene diamine and/or alkyl oxybenzene sulphonate.

[0086] **Bleach catalyst:** The composition may comprise a bleach catalyst. Suitable bleach catalysts include oxaziridinium bleach catalysts, transistion metal bleach catalysts, especially manganese and iron bleach catalysts. A suitable bleach catalyst has a structure corresponding to general formula below:



wherein R^{13} is selected from the group consisting of 2-ethylhexyl, 2-propylheptyl, 2-butyloctyl, 2-pentylnonyl, 2-hexyldecyl, n-dodecyl, n-tetradecyl, n-hexadecyl, n-octadecyl, iso-nonyl, isodecyl, iso-tridecyl and iso-pentadecyl.

[0087] **Pre-formed peracid:** Suitable pre-form peracids include phthalimido-peroxycaproic acid. However, it is preferred that the composition is substantially free of pre-formed peracid. By: "substantially free" it is meant: "no deliberately added".

[0088] **Enzymes:** Suitable enzymes include lipases, proteases, cellulases, amylases and any combination thereof.

[0089] **Protease:** Suitable proteases include metalloproteases and/or serine proteases. Examples of suitable neutral or alkaline proteases include: subtilisins (EC 3.4.21.62); trypsin-type or chymotrypsin-type proteases; and metalloproteases. The suitable proteases include chemically or genetically modified mutants of the aforementioned suitable proteases.

[0090] Suitable commercially available protease enzymes include those sold under the trade names Alcalase®, Savinase®, Primase®, Durazym®, Polarzyme®, Kannase®, Liquanase®, Liquanase Ultra®, Savinase Ultra®, Ovozyme®, Neutrase®, Everlase® and Esperase® by Novozymes A/S (Denmark), those sold under the tradename Maxatase®, Maxacal®, Maxapem®, Preferenz P® series of proteases including Preferenz® P280, Preferenz® P281, Preferenz® P2018-C, Preferenz® P2081-WE, Preferenz® P2082-EE and Preferenz® P2083-A/J, Properase®, Purafect®, Purafect Prime®, Purafect Ox®, FN3®, FN4®, Excellase® and Purafect OXP® by DuPont, those sold under the tradename Opticlean® and Optimase® by Solvay Enzymes, those available from Henkel/ Kemira, namely BLAP (sequence shown in Figure 29 of US 5,352,604 with the folowing mutations S99D + S101 R + S103A + V104I + G159S, hereinafter referred to as BLAP), BLAP R (BLAP with S3T + V4I + V199M + V205I + L217D), BLAP X (BLAP with S3T + V4I + V205I) and BLAP F49 (BLAP with S3T + V4I + A194P + V199M + V205I + L217D) - all from Henkel/Kemira; and KAP (Bacillus alkalophilus subtilisin with mutations A230V + S256G + S259N) from Kao.

[0091] A suitable protease is described in WO11/140316 and WO11/072117.

[0092] **Amylase:** Suitable amylases are derived from AA560 alpha amylase endogenous to Bacillus sp. DSM 12649, preferably having the following mutations: R118K, D183*, G184*, N195F, R320K, and/or R458K. Suitable commercially available amylases include Stainzyme®, Stainzyme® Plus, Natalase, Termamyl®, Termamyl® Ultra, Liquezyme® SZ, Duramyl®, Everest® (all Novozymes) and Spezyme® AA, Preferenz S® series of amylases, Purastar® and Purastar® Ox Am, Optisize® HT Plus (all Du Pont).

A suitable amylase is described in WO06/002643.

[0093] **Cellulase:** Suitable cellulases include those of bacterial or fungal origin. Chemically modified or protein engineered mutants are also suitable. Suitable cellulases include cellulases from the genera *Bacillus, Pseudomonas, Humicola, Fusarium, Thielavia, Acremonium,* e.g., the fungal cellulases produced from *Humicola insolens, Myceliophthora thermophila* and *Fusarium oxysporum.*

[0094] Commercially available cellulases include Celluzyme®, Carezyme®, and Carezyme® Premium, Celluclean® and Whitezyme® (Novozymes A/S), Revitalenz® series of enzymes (Du Pont), and Biotouch® series of enzymes (AB Enzymes). Suitable commercially available cellulases include Carezyme® Premium, Celluclean® Classic. Suitable cellulases are described in WO07/144857 and WO10/056652.

[0095] **Lipase:** Suitable lipases include those of bacterial, fungal or synthetic origin, and variants thereof. Chemically modified or protein engineered mutants are also suitable. Examples of suitable lipases include lipases from *Humicola* (synonym *Thermomyces),* e.g., from *H. lanuginosa* (*T. lanuginosus*).

[0096] The lipase may be a "first cycle lipase", e.g. such as those described in WO06/090335 and WO13/116261. In one aspect, the lipase is a first-wash lipase, preferably a variant of the wild-type lipase from Thermomyces lanuginosus comprising T231R and/or N233R mutations. Preferred lipases include those sold under the tradenames Lipex®, Lipolex® and Lipoclean® by Novozymes, Bagsvaerd, Denmark.

[0097] Other suitable lipases include: Liprl 139, e.g. as described in WO2013/171241; and TfuLip2, e.g. as described in WO2011/084412 and WO2013/033318.

[0098] **Other enzymes:** Other suitable enzymes are bleaching enzymes, such as peroxidases/oxidases, which include those of plant, bacterial or fungal origin and variants thereof. Commercially available peroxidases include Guardzyme® (Novozymes A/S). Other suitable enzymes include choline oxidases and perhydrolases such as those used in Gentle Power Bleach™.

[0099] Other suitable enzymes include pectate lyases sold under the tradenames X-Pect®, Pectaway® (from Novozymes A/S, Bagsvaerd, Denmark) and PrimaGreen® (DuPont) and mannanases sold under the tradenames Mannaway® (Novozymes A/S, Bagsvaerd, Denmark), and Mannastar® (Du Pont).

[0100] **Identity:** When used herein identity or sequence identity refers to the relatedness between two amino acid sequences.

[0101] For purposes of the present invention, the degree of sequence identity between two amino acid sequences is determined using the Needleman-Wunsch algorithm (Needleman and Wunsch, 1970, J. Mol. Biol. 48: 443-453) as implemented in the Needle program of the EMBOSS package (EMBOSS: The European Molecular Biology Open Software Suite, Rice et al., 2000, Trends Genet. 16: 276-277), preferably version 3.0.0 or later. The optional parameters used are gap open penalty of 10, gap extension penalty of 0.5, and the EBLOSUM62 (EMBOSS version of BLOSUM62) substitution matrix. The output of Needle labeled "longest identity" (obtained using the -nobrief option) is used as the percent identity and is calculated as follows:

$$\text{(Identical Residues x 100)/(Length of Alignment – Total Number of Gaps in Alignment).}$$

[0102] **Brightener:** Suitable fluorescent brighteners include: di-styryl biphenyl compounds, e.g. Tinopal® CBS-X, diamino stilbene di-sulfonic acid compounds, e.g. Tinopal® DMS pure Xtra and Blankophor® HRH, and Pyrazoline com-

pounds, e.g. Blankophor® SN, and coumarin compounds, e.g. Tinopal® SWN.

Preferred brighteners are: sodium 2 (4-styryl-3-sulfophenyl)-2H-napthol[1,2-d]triazole, disodium 4,4'-bis{[(4-anilino-6-(N methyl-N-2hydroxyethyl)amino 1 ,3,5- triazin-2-yl)]amino}stilbene-2-2' disulfonate, disodium 4,4'-bis{[(4-anilino-6-morpholino-1,3,5-triazin-2-yl)]amino} stilbene-2-2' disulfonate, and disodium 4,4'- bis(2-sulfostyryl)biphenyl. A suitable fluorescent brightener is C.I. Fluorescent Brightener 260, which may be used in its beta or alpha crystalline forms, or a mixture of these forms.

[0103] **Hueing agent:** Suitable hueing agents include small molecule dyes, typically falling into the Colour Index (C.I.) classifications of Acid, Direct, Basic, Reactive (including hydrolysed forms thereof) or Solvent or Disperse dyes, for example classified as Blue, Violet, Red, Green or Black, and provide the desired shade either alone or in combination. Preferred such hueing agents include Acid Violet 50, Direct Violet 9, 66 and 99, Solvent Violet 13 and any combination thereof.

[0104] Many hueing agents are known and described in the art which may be suitable for the present invention, such as hueing agents described in WO2014/089386.

[0105] Suitable hueing agents include phthalocyanine and azo dye conjugates, such as described in WO2009/069077.

[0106] Suitable hueing agents may be alkoxylated. Such alkoxylated compounds may be produced by organic synthesis that may produce a mixture of molecules having different degrees of alkoxylation. Such mixtures may be used directly to provide the hueing agent, or may undergo a purification step to increase the proportion of the target molecule. Suitable hueing agents include alkoxylated bis-azo dyes, such as described in WO2012/054835, and/or alkoxylated thiophene azo dyes, such as described in WO2008/087497 and WO2012/166768.

[0107] The hueing agent may be incorporated into the detergent composition as part of a reaction mixture which is the result of the organic synthesis for a dye molecule, with optional purification step(s). Such reaction mixtures generally comprise the dye molecule itself and in addition may comprise un-reacted starting materials and/or by-products of the organic synthesis route. Suitable hueing agents can be incorporated into hueing dye particles, such as described in WO 2009/069077.

[0108] **Reserve alkalinity:** Typically, the composition at 1wt% dilution in deionized water at 20°C, has a reserve alkalinity to pH 7.5 of less than 3.0gNaOH/100g, preferably less than 2.5gNaOH/100g, or even less than 2.0gNaOH/100g.

[0109] As used herein, the term "reserve alkalinity" is a measure of the buffering capacity of the detergent composition (g/NaOH/100g detergent composition) determined by titrating a 1% (w/v) solution of detergent composition with hydrochloric acid to pH 7.5 i.e. in order to calculate Reserve Alkalinity as defined herein:

$$\text{Reserve Alkalinity (to pH 7.5) as \% alkali in g NaOH/100 g product} = \frac{T \times M \times 40 \times Vol}{10 \times Wt \times Aliquot}$$

T	= titre (ml) to pH 7.5
M	= Molarity of HCl = 0.2
40	= Molecular weight of NaOH
Vol	= Total volume (ie. 1000 ml)
W	= Weight of product (10 g)
Aliquot	= (100 ml)

[0110] Obtain a 10g sample accurately weighed to two decimal places, of fully formulated detergent composition. The sample should be obtained using a Pascall sampler in a dust cabinet. Add the 10g sample to a plastic beaker and add 200 ml of carbon dioxide-free de-ionised water. Agitate using a magnetic stirrer on a stirring plate at 150 rpm until fully dissolved and for at least 15 minutes. Transfer the contents of the beaker to a 1 litre volumetric flask and make up to 1 litre with deionised water. Mix well and take a 100 mls ± 1 ml aliquot using a 100 mls pipette immediately. Measure and record the pH and temperature of the sample using a pH meter capable of reading to ±0.01pH units, with stirring, ensuring temperature is 20°C +/- 2°C. Titrate whilst stirring with 0.2M hydrochloric acid until pH measures exactly 7.5. Note the millilitres of hydrochloric acid used. Take the average titre of three identical repeats. Carry out the calculation described above to calculate the reserve alkalinity to pH 7.5.

EXAMPLES

Illustrative Example

[0111]

Ingredient	Amount (in wt%)
Anionic detersive surfactant (such as alkyl benzene sulphonate, alkyl ethoxylated sulphate, alkyl ether carboxylic acid, and mixtures thereof)	from 15wt% to 35wt%
Non-ionic detersive surfactant (such as alkyl ethoxylated alcohol)	from 0.1wt% to 5wt%
Carboxylate polymer (such as co-polymers of maleic acid and acrylic acid and/or carboxylate polymers comprising ether moieties and sulfonate moieties)	from 0wt% to 4wt%
Polyethylene glycol polymer (such as a polyethylene glycol polymer comprising polyvinyl acetate side chains)	from 0wt% to 4wt%
Polyester soil release polymer (such as Repel-o-tex and/or Texcare polymers)	from 0wt% to 2wt%
Cellulosic polymer (such as carboxymethyl cellulose, methyl cellulose and combinations thereof)	from 0wt% to 2wt%
Other polymer (such as care polymers)	from 0wt% to 4wt%
Citric acid and/or sodium citrate	from 10wt% to 40wt%
Inorganic salts (such as sodium carbonate, sodium sesquicarbonate, sodium bicarbonate and combinations thereof)	from 10wt% to 40wt%
Amino acid derivative complexing agent (such as MGDA, GLDA, ASDA and combination thereof)	from 0.1wt% to 40wt%
Amylase	from 0.001 wt% to 0.1wt%
Metalloprotease (such as a M4 metalloprotease)	from 0.001wt% to 0.1wt%
Lipase	from 0.001 wt% to 0.1wt%
Cellulase	from 0wt% to 0.1wt%
Pectate Lyase	from 0wt% to 0.1wt%
Mannanase	from 0wt% to 0.1wt%
Subtilisin-type protease	from 0wt% to 0.1wt%
Fluorescent brightener	from 0wt% to 1.0wt%
Alkoxylated polyaryl/polyalkyl phenol	from 0.5wt% to 20wt%
Hueing dye	from 0.001 wt% to 0.5wt%
Organic pigment and/or inorganic pigment	from 0.001wt% to 0.5wt%
Other ingredients & miscellaneous	balance to 100wt%

[0112] The dimensions and values disclosed herein are not to be understood as being strictly limited to the exact numerical values recited. Instead, unless otherwise specified, each such dimension is intended to mean both the recited value and a functionally equivalent range surrounding that value. For example, a dimension disclosed as "40 mm" is

intended to mean "about 40 mm."

SEQUENCE LISTING

<110> THE PROCTER & GAMBLE COMPANY

<120> LAUNDRY DETERGENT COMPOSITION

<130> CM04667FM

<150> 16206487.7
<151> 2016-12-22

<160> 4

<170> PatentIn version 3.5

<210> 1
<211> 485
<212> PRT
<213> Artificial Sequence

<220>
<223> Hybrid protein

<400> 1

```
His His Asn Gly Thr Asn Gly Thr Met Met Gln Tyr Phe Glu Trp Tyr
1               5                  10                  15

Leu Pro Asn Asp Gly Asn His Trp Asn Arg Leu Asn Ser Asp Ala Ser
            20                  25                  30

Asn Leu Lys Ser Lys Gly Ile Thr Ala Val Trp Ile Pro Pro Ala Trp
        35                  40                  45

Lys Gly Ala 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 Val Arg Thr Lys Tyr Gly
65                  70                  75                  80

Thr Arg Ser Gln Leu Gln Ala Ala Val Thr Ser Leu Lys Asn Asn Gly
                85                  90                  95

Ile Gln Val Tyr Gly Asp Val Val Met Asn His Lys Gly Gly Ala Asp
            100                 105                 110

Ala Thr Glu Met Val Arg Ala Val Glu Val Asn Pro Asn Asn Arg Asn
        115                 120                 125

Gln Glu Val Thr Gly Glu Tyr Thr Ile Glu Ala Trp Thr Arg Phe Asp
    130                 135                 140

Phe Pro Gly Arg Gly Asn Thr His Ser Ser Phe Lys Trp Arg Trp Tyr
145                 150                 155                 160
```

```
His Phe Asp Gly Val Asp Trp Asp Gln Ser Arg Arg Leu Asn Asn Arg
                165                 170                 175

Ile Tyr Lys Phe Arg Gly His Gly Lys Ala Trp Asp Trp Glu Val Asp
            180                 185                 190

Thr Glu Asn Gly Asn Tyr Asp Tyr Leu Met Tyr Ala Asp Ile Asp Met
        195                 200                 205

Asp His Pro Glu Val Val Asn Glu Leu Arg Asn Trp Gly Val Trp Tyr
    210                 215                 220

Thr Asn Thr Leu Gly Leu Asp Gly Phe Arg Ile Asp Ala Val Lys His
225                 230                 235                 240

Ile Lys Tyr Ser Phe Thr Arg Asp Trp Ile Asn His Val Arg Ser Ala
                245                 250                 255

Thr Gly Lys Asn Met Phe Ala Val Ala Glu Phe Trp Lys Asn Asp Leu
            260                 265                 270

Gly Ala Ile Glu Asn Tyr Leu Gln Lys Thr Asn Trp Asn His Ser Val
        275                 280                 285

Phe Asp Val Pro Leu His Tyr Asn Leu Tyr Asn Ala Ser Lys Ser Gly
    290                 295                 300

Gly Asn Tyr Asp Met Arg Asn Ile Phe Asn Gly Thr Val Val Gln Arg
305                 310                 315                 320

His Pro Ser His Ala Val Thr Phe Val Asp Asn His Asp Ser Gln Pro
                325                 330                 335

Glu Glu Ala Leu Glu Ser Phe Val Glu Glu Trp Phe Lys Pro Leu Ala
            340                 345                 350

Tyr Ala Leu Thr Leu Thr Arg Glu Gln Gly Tyr Pro Ser Val Phe Tyr
        355                 360                 365

Gly Asp Tyr Tyr Gly Ile Pro Thr His Gly Val Pro Ala Met Arg Ser
    370                 375                 380

Lys Ile Asp Pro Ile Leu Glu Ala Arg Gln Lys Tyr Ala Tyr Gly Pro
385                 390                 395                 400

Gln His Asp Tyr Ile Asp His Pro Asp Val Ile Gly Trp Thr Arg Glu
```

405 410 415

Gly Asp Ser Ser Ala Ala Lys Ser Gly Leu Ala Ala Leu Ile Thr Asp
420 425 430

Gly Pro Gly Gly Ser Lys Arg Met Tyr Ala Gly Leu Lys Asn Ala Gly
435 440 445

Glu Thr Trp Tyr Asp Ile Thr Gly Asn Arg Ser Asp Thr Val Lys Ile
450 455 460

Gly Ser Asp Gly Trp Gly Glu Phe His Val Asn Asp Gly Ser Val Ser
465 470 475 480

Ile Tyr Val Gln Lys
485

<210> 2
<211> 269
<212> PRT
<213> Thermomyces lanuginosus

<400> 2

Glu Val Ser Gln Asp Leu Phe Asn Gln Phe Asn Leu Phe Ala Gln Tyr
1 5 10 15

Ser Ala Ala Ala Tyr Cys Gly Lys Asn Asn Asp Ala Pro Ala Gly Thr
20 25 30

Asn Ile Thr Cys Thr Gly Asn Ala Cys Pro Glu Val Glu Lys Ala Asp
35 40 45

Ala Thr Phe Leu Tyr Ser Phe Glu Asp Ser Gly Val Gly Asp Val Thr
50 55 60

Gly Phe Leu Ala Leu Asp Asn Thr Asn Lys Leu Ile Val Leu Ser Phe
65 70 75 80

Arg Gly Ser Arg Ser Ile Glu Asn Trp Ile Gly Asn Leu Asn Phe Asp
85 90 95

Leu Lys Glu Ile Asn Asp Ile Cys Ser Gly Cys Arg Gly His Asp Gly
100 105 110

Phe Thr Ser Ser Trp Arg Ser Val Ala Asp Thr Leu Arg Gln Lys Val
115 120 125

Glu Asp Ala Val Arg Glu His Pro Asp Tyr Arg Val Val Phe Thr Gly

```
    130                 135                 140

His Ser Leu Gly Gly Ala Leu Ala Thr Val Ala Gly Ala Asp Leu Arg
145                 150                 155                 160

Gly Asn Gly Tyr Asp Ile Asp Val Phe Ser Tyr Gly Ala Pro Arg Val
                165                 170                 175

Gly Asn Arg Ala Phe Ala Glu Phe Leu Thr Val Gln Thr Gly Gly Thr
            180                 185                 190

Leu Tyr Arg Ile Thr His Thr Asn Asp Ile Val Pro Arg Leu Pro Pro
        195                 200                 205

Arg Glu Phe Gly Tyr Ser His Ser Ser Pro Glu Tyr Trp Ile Lys Ser
    210                 215                 220

Gly Thr Leu Val Pro Val Thr Arg Asn Asp Ile Val Lys Ile Glu Gly
225                 230                 235                 240

Ile Asp Ala Thr Gly Gly Asn Asn Gln Pro Asn Ile Pro Asp Ile Pro
                245                 250                 255

Ala His Leu Trp Tyr Phe Gly Leu Ile Gly Thr Cys Leu
            260                 265
```

<210> 3
<211> 316
<212> PRT
<213> Bacillus thermoproteolyticus

<400> 3

```
Ile Thr Gly Thr Ser Thr Val Gly Val Gly Arg Gly Val Leu Gly Asp
1               5                   10                  15

Gln Lys Asn Ile Asn Thr Thr Tyr Ser Thr Tyr Tyr Tyr Leu Gln Asp
            20                  25                  30

Asn Thr Arg Gly Asn Gly Ile Phe Thr Tyr Asp Ala Lys Tyr Arg Thr
        35                  40                  45

Thr Leu Pro Gly Ser Leu Trp Ala Asp Ala Asp Asn Gln Phe Phe Ala
    50                  55                  60

Ser Tyr Asp Ala Pro Ala Val Asp Ala His Tyr Tyr Ala Gly Val Thr
65                  70                  75                  80

Tyr Asp Tyr Tyr Lys Asn Val His Asn Arg Leu Ser Tyr Asp Gly Asn
```

```
                85                  90                  95

Asn Ala Ala Ile Arg Ser Ser Val His Tyr Ser Gln Gly Tyr Asn Asn
            100                 105                 110

Ala Phe Trp Asn Gly Ser Gln Met Val Tyr Gly Asp Gly Asp Gly Gln
        115                 120                 125

Thr Phe Ile Pro Leu Ser Gly Gly Ile Asp Val Val Ala His Glu Leu
    130                 135                 140

Thr His Ala Val Thr Asp Tyr Thr Ala Gly Leu Ile Tyr Gln Asn Glu
145                 150                 155                 160

Ser Gly Ala Ile Asn Glu Ala Ile Ser Asp Ile Phe Gly Thr Leu Val
                165                 170                 175

Glu Phe Tyr Ala Asn Lys Asn Pro Asp Trp Glu Ile Gly Glu Asp Val
            180                 185                 190

Tyr Thr Pro Gly Ile Ser Gly Asp Ser Leu Arg Ser Met Ser Asp Pro
        195                 200                 205

Ala Lys Tyr Gly Asp Pro Asp His Tyr Ser Lys Arg Tyr Thr Gly Thr
    210                 215                 220

Gln Asp Asn Gly Gly Val His Ile Asn Ser Gly Ile Ile Asn Lys Ala
225                 230                 235                 240

Ala Tyr Leu Ile Ser Gln Gly Gly Thr His Tyr Gly Val Ser Val Val
                245                 250                 255

Gly Ile Gly Arg Asp Lys Leu Gly Lys Ile Phe Tyr Arg Ala Leu Thr
            260                 265                 270

Gln Tyr Leu Thr Pro Thr Ser Asn Phe Ser Gln Leu Arg Ala Ala Ala
        275                 280                 285

Val Gln Ser Ala Thr Asp Leu Tyr Gly Ser Thr Ser Gln Glu Val Ala
    290                 295                 300

Ser Val Lys Gln Ala Phe Asp Ala Val Gly Val Lys
305                 310                 315
```

<210> 4
<211> 300
<212> PRT
<213> Bacillus amyloliquefaciens

<400> 4

```
Ala Ala Thr Thr Gly Thr Gly Thr Thr Leu Lys Gly Lys Thr Val Ser
1               5                  10                  15

Leu Asn Ile Ser Ser Glu Ser Gly Lys Tyr Val Leu Arg Asp Leu Ser
            20                  25                  30

Lys Pro Thr Gly Thr Gln Ile Ile Thr Tyr Asp Leu Gln Asn Arg Glu
        35                  40                  45

Tyr Asn Leu Pro Gly Thr Leu Val Ser Ser Thr Thr Asn Gln Phe Thr
    50                  55                  60

Thr Ser Ser Gln Arg Ala Ala Val Asp Ala His Tyr Asn Leu Gly Lys
65                  70                  75                  80

Val Tyr Asp Tyr Phe Tyr Gln Lys Phe Asn Arg Asn Ser Tyr Asp Asn
                85                  90                  95

Lys Gly Gly Lys Ile Val Ser Ser Val His Tyr Gly Ser Arg Tyr Asn
            100                 105                 110

Asn Ala Ala Trp Ile Gly Asp Gln Met Ile Tyr Gly Asp Gly Asp Gly
        115                 120                 125

Ser Phe Phe Ser Pro Leu Ser Gly Ser Met Asp Val Thr Ala His Glu
    130                 135                 140

Met Thr His Gly Val Thr Gln Glu Thr Ala Asn Leu Asn Tyr Glu Asn
145                 150                 155                 160

Gln Pro Gly Ala Leu Asn Glu Ser Phe Ser Asp Val Phe Gly Tyr Phe
                165                 170                 175

Asn Asp Thr Glu Asp Trp Asp Ile Gly Glu Asp Ile Thr Val Ser Gln
            180                 185                 190

Pro Ala Leu Arg Ser Leu Ser Asn Pro Thr Lys Tyr Gly Gln Pro Asp
        195                 200                 205

Asn Phe Lys Asn Tyr Lys Asn Leu Pro Asn Thr Asp Ala Gly Asp Tyr
    210                 215                 220

Gly Gly Val His Thr Asn Ser Gly Ile Pro Asn Lys Ala Ala Tyr Asn
225                 230                 235                 240
```

```
Thr Ile Thr Lys Ile Gly Val Asn Lys Ala Glu Gln Ile Tyr Tyr Arg
                245                 250                 255

Ala Leu Thr Val Tyr Leu Thr Pro Ser Ser Thr Phe Lys Asp Ala Lys
            260                 265                 270

Ala Ala Leu Ile Gln Ser Ala Arg Asp Leu Tyr Gly Ser Gln Asp Ala
        275                 280                 285

Ala Ser Val Glu Ala Ala Trp Asn Ala Val Gly Leu
    290                 295                 300
```

Claims

1. A solid laundry detergent composition comprising:

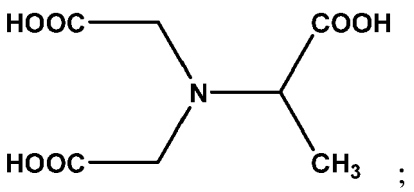
(a) from 20wt% to 39wt% detersive surfactant selected from anionic detersive surfactant and/or non-ionic detersive surfactant;
(b) from 10wt% to 40wt% inorganic salts selected from sodium carbonate, sodium sesquicarbonate, sodium bicarbonate and any mixtures thereof;
(c) optionally, from 10wt% to 40wt% citric acid and/or salts thereof;
(d) from 0.001wt% to 1.0wt% metalloprotease enzyme,

wherein at 1wt% dilution in de-ionised water at 20°C, the composition has a pH in the range of from 7.6 to 10.0,
wherein at 1wt% dilution in de-ionised water at 20°C, the composition has a reserve alkalinity to pH 7.5 of greater than 3.0,
wherein the composition is in the form of a coated laundry detergent particle that is curved and has perpendicular dimensions x, y and z,
wherein x is from 0.5mm to 2.0mm,
wherein y is from 2.0mm to 8.0mm, and
wherein z is from 2.0mm to 8.0mm,
wherein the coating comprises the inorganic salt (b), and wherein the core comprises the detersive surfactant (a).

2. A composition according to claim 1, wherein the metalloprotease enzyme is selected from the M4 Metalloprotease Family.

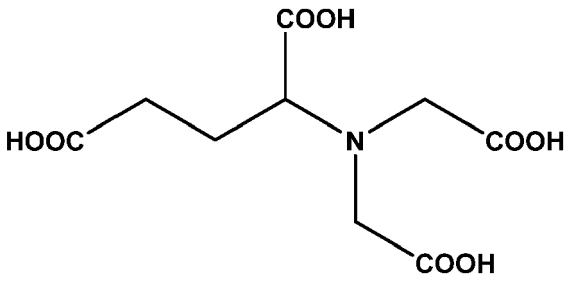
3. A composition according to any preceding claim, wherein the composition comprises from 0.1wt% to 40wt% amino acid derivative complexing agent selected from one or more of the following, in any stereoisomer or mixture of stereoisomer form:

(3)(i) methylglycinediacetic acid and salts thereof (MGDA)



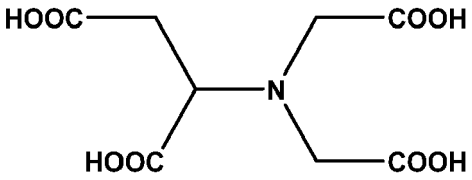
;

(3)(ii) L-glutamic acid, N,N-diacetic acid and salts thereof (GLDA)



;

and
(3)(iii) L-aspartic acid N,N-diacetic acid and salts thereof (ASDA)



.

4. A composition according to any preceding claim, wherein the composition comprises from 0.001wt% to 1.0wt% amylase variant comprising:

(4)(i) a deletion and/or a substitution at two or more positions corresponding to positions R181 , G182, H183 and G184 of the mature polypeptide of SEQ ID NO: 1 , and
(4)(ii) a substitution at one or more positions said substitutions selected from the group consisting of:

I206Y;F;Q;P;R;V;C;G;A;C;D;E;H;K;L;M;N;S;T, particularly I206Y;F;C;L;H;S,
N195F;Y;H;K;L,
L63Q;P;R;V;F;C;G;A;C;D;E;H;K;I;M;N;S;T;Y, particularly L63V,
A113M;R;W;I;L,
M116F;Y;I;W;L,
R118P;Q;V;F;C;G;A;C;D;E;H;I;K;L;M;N;S;T;Y, particularly R118P;Q;V;F;C;G, N128C,
Q129P;R;V;F;C;G;A;C;D;E;H;I;K;L;M;N;S;T;Y, particularly Q129E, G133N,
A139Q;P;R;V;F;C;G;C;D;E;H;I;K;L;M;N;S;T;Y, particularly A139T,
R142H;V;L;Q;I,
A186E;N;Q;S,
E190P;R;V;F;C;G;A;C;D;Q;H;I;K;L;M;N;S;T;Y, particularly E190P,
A204Q;P;R;V;F;C;G;C;D;E;H;I;K;L;M;N;S;T;Y, particularly A204T,
H210M;D;C;A;Q;S;F;N;E;T,
P211Q;R;V;F;C;G;A;C;D;E;H;1;K;L;M;N;S;T;Y,particularly
P211L;M;S;Q;G;V;W;A;H;T;R;
E212T;R;S;V;L;Y;R;T;G;
V213Q;P;R;F;C;G;A;C;D;E;H;I;K;L;M;N;S;T;Y, particularly V213T;A;G;S;C;L;P,
V214Q;P;R;F;C;G;A;C;D;E;H;I;K;L;M;N;S;T;Y, particularly V214T;I,
L217M;Q;V;I;H, particularly L217V,
Y243Q;P;R;F;C;G;A;C;D;E;H;I;K;L;M;N;S;T;V, particularly Y243F,
S244Q;P;R;F;C;G;A;C;D;E;H;I;K;L;M;N;Y;T;V, particularly S244Q,
T246Q;P;R;F;C;G;A;C;D;E;H;I;K;L;M;N;Y;S;V, particularly T246Q;M,
N260E, Q280S, N311R, F343W, D418C, S419M, S420Q;R and Y482W,

where the positions correspond to the positions of SEQ ID NO 1 and wherein the amylase variant has at least 95%, such as at least 96%, or at least 97%, or at least 98%, or at least 99% but less than 100% sequence identity to the polypeptide having the amino acid sequence of SEQ ID NO: 1 and wherein the variant has alpha-amylase activity.

5. A composition according to any preceding claim, wherein the composition comprises from 0.001wt% to 1.0wt%

lipase that is a variant of SEQ ID NO:2 comprising:

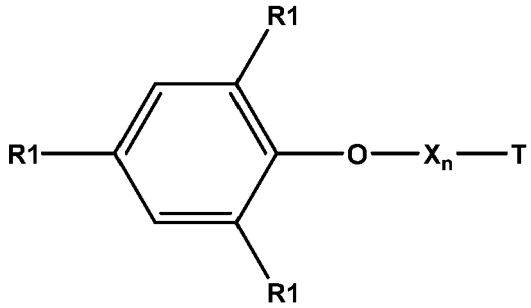
(5)(a) substitutions T231R and N233R

and

(5)(b) at least three further substitutions selected from D27R, N33Q, G38A, D96E, D111A, G91Q, G163K, E210Q, D254S, I255A, and P256T;

where the positions correspond to the positions of SEQ ID NO 2 and wherein the lipase variant has at least 95% but less than 100% sequence identity to the polypeptide having the amino acid sequence of SEQ ID NO: 2 and wherein the variant has lipase activity.

6. A composition according to any preceding claim, wherein the composition comprises from 0.5wt% to 20wt% alkoxylated polyaryl/polyalkyl phenol has the following structure:



wherein R_1 is selected from linear of branched C_3-C_{15} alkyl groups and aryl groups, X is selected from ethoxy or propoxy groups, n is from 2 to 70, T is selected from H, SO_3^-, COO^- and PO_3^{2-}.

7. A composition according to any preceding claim, wherein the composition comprises from 0.5wt% to 20wt% alkyl ether carboxylic acid having the following structure:

$$R\text{-}(OCH_2CH_2)n\text{-}OCH_2\text{-}COOH$$

wherein,

R is selected from saturated and mono-unsaturated C_{10} to C_{26} linear or branched alkyl chains, and
n is selected from 5 to 20.

8. A composition according to any preceding claim, wherein the detersive surfactant comprises from C_8-C_{24} alkyl ethoxylated alcohol having an average degree of ethoxylation of from 20 to 50, and wherein the compositon comprises from 1wt% to 10wt% C_8-C_{24} alkyl ethoxylated alcohol having an average degree of ethoxylation of from 20 to 50.

9. A composition according to any preceding claim, wherein the composition comprises from 0.05wt% to 4.0wt% soil release polymer.

10. A composition according to any preceding claim, wherein the composition comprises from 0.1wt% to 3.0wt% carboxymethylcellulose (CMC).

11. A composition according to any preceding claim, wherein the composition comprises from 0.1wt% to 5.0wt% calcite.

12. A composition according to any preceding claim, wherein the composition comprises from 1wt% to 10wt% carboxylate polymer.

13. A composition according to any preceding claim, wherein the composition comprises less than 10wt% total level of silicates and aluminosilicates.

14. A composition according to any preceding claim, wherein the composition comprises from 0.001wt% to 0.5wt% hueing dye.

15. A composition according to any preceding claim, wherein the composition comprises from 0.001wt% to 0.5wt% organic pigment and/or inorganic pigment.

16. A composition according to any preceding claim, wherein the composition comprises from 0.2 wt% to 10wt% chelant.

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 17 17 3004

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	WO 2013/139702 A1 (UNILEVER PLC [GB]; UNILEVER NV [NL]; CONOPCO INC DBA UNILEVER [US]) 26 September 2013 (2013-09-26) * page 18, line 1 - page 21, line 4; claims; examples *	1-16	INV. C11D3/10 C11D3/386 C11D17/00
A	WO 2015/158723 A1 (NOVOZYMES AS [DK]) 22 October 2015 (2015-10-22) * claims; examples *	1-16	
A	WO 2016/041681 A1 (BASF SE [DE]) 24 March 2016 (2016-03-24) * claims; example II *	1-16	
A	WO 2015/189371 A1 (NOVOZYMES AS [DK]) 17 December 2015 (2015-12-17) * claims *	1-16	
A	WO 2016/102356 A1 (NOVOZYMES AS [DK]) 30 June 2016 (2016-06-30) * claims; examples *	1-16	TECHNICAL FIELDS SEARCHED (IPC)
A	WO 2016/041679 A1 (UNILEVER PLC [GB]; UNILEVER NV [NL]; CONOPCO INC DBA UNILEVER [US]) 24 March 2016 (2016-03-24) * claims; examples *	1-16	C11D
A	WO 00/40691 A1 (PROCTER & GAMBLE [US]; MAO HSIANG KUEN [JP]) 13 July 2000 (2000-07-13) * claims; examples *	1-16	
A	US 5 776 879 A (SHIH JENN S [US] ET AL) 7 July 1998 (1998-07-07) * claims; examples *	1-16	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	7 September 2017	Vernier, Frédéric

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 17 17 3004

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

07-09-2017

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2013139702 A1	26-09-2013	AR 090436 A1	12-11-2014
		WO 2013139702 A1	26-09-2013
WO 2015158723 A1	22-10-2015	CN 106164264 A	23-11-2016
		EP 3132032 A1	22-02-2017
		US 2017114301 A1	27-04-2017
		WO 2015158723 A1	22-10-2015
WO 2016041681 A1	24-03-2016	CA 2960541 A1	24-03-2016
		CN 106715668 A	24-05-2017
		EP 3194553 A1	26-07-2017
		KR 20170061687 A	05-06-2017
		WO 2016041681 A1	24-03-2016
WO 2015189371 A1	17-12-2015	CN 106414729 A	15-02-2017
		EP 3155097 A1	19-04-2017
		US 2017121695 A1	04-05-2017
		WO 2015189371 A1	17-12-2015
WO 2016102356 A1	30-06-2016	AR 103225 A1	26-04-2017
		CA 2966292 A1	30-06-2016
		CN 107109382 A	29-08-2017
		WO 2016102356 A1	30-06-2016
WO 2016041679 A1	24-03-2016	AR 101879 A1	18-01-2017
		AU 2015317181 A1	23-02-2017
		CN 106661504 A	10-05-2017
		EP 3194546 A1	26-07-2017
		WO 2016041679 A1	24-03-2016
WO 0040691 A1	13-07-2000	AU 2311199 A	24-07-2000
		EP 1141219 A1	10-10-2001
		WO 0040691 A1	13-07-2000
US 5776879 A	07-07-1998	US 5776879 A	07-07-1998
		US 5929175 A	27-07-1999
		US 6093776 A	25-07-2000
		US 6103831 A	15-08-2000

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- WO 2010122050 A **[0012]**
- US 20080293610 A1 **[0054]**
- WO 201471410 A **[0056]**
- WO 2007044993 A **[0059]**
- WO 2009058661 A **[0059]**
- US 20140315775 A **[0059]**
- WO 08007320 A **[0076]**
- WO 09154933 A **[0078]**
- US 5352604 A **[0090]**
- WO 11140316 A **[0091]**
- WO 11072117 A **[0091]**
- WO 06002643 A **[0092]**
- WO 07144857 A **[0094]**
- WO 10056652 A **[0094]**
- WO 06090335 A **[0096]**
- WO 13116261 A **[0096]**
- WO 2013171241 A **[0097]**
- WO 2011084412 A **[0097]**
- WO 2013033318 A **[0097]**
- WO 2014089386 A **[0104]**
- WO 2009069077 A **[0105] [0107]**
- WO 2012054835 A **[0106]**
- WO 2008087497 A **[0106]**
- WO 2012166768 A **[0106]**

Non-patent literature cited in the description

- **NEEDLEMAN ; WUNSCH.** *J. Mol. Biol.,* 1970, vol. 48, 443-453 **[0101]**
- **RICE et al.** *Trends Genet.,* 2000, vol. 16, 276-277 **[0101]**