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(54) **LAUNDRY DETERGENT COMPOSITION**

(57) The present invention relates to a solid laundry detergent composition comprising:

(a) from 20wt% to 39wt% deterative surfactant selected from anionic deterative surfactant and/or non-ionic deterative 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% lipase that is a variant of SEQ ID NO:2 comprising:

(d)(a) substitutions T231R and N233R

and

(d)(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,

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 deterative surfactant (a).

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**Description**

## FIELD OF THE INVENTION

5 **[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

10 **[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.

15 **[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.

20 **[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.

25 **[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.

30 **[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.

35

## SUMMARY OF THE INVENTION

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

40 (a) from 20wt% to 39wt% deterative surfactant selected from anionic deterative surfactant and/or non-ionic deterative 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;

45 (d) from 0.001wt% to 1.0wt% lipase that is a variant of SEQ ID NO:2 comprising:

(d)(a) substitutions T231R and N233R  
and

50 (d)(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,

55 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,

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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  
5 wherein z is from 2.0mm to 8.0mm,  
wherein the coating comprises the inorganic salt (b), and wherein the core comprises the deterative surfactant (a).

### DETAILED DESCRIPTION OF THE INVENTION

10 **[0008] Solid laundry detergent composition:** The solid laundry detergent composition comprises:

- (a) from 20wt% to 39wt% deterative surfactant selected from anionic deterative surfactant and/or non-ionic deterative surfactant;
- 15 (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% lipase that is a variant of SEQ ID NO:2 comprising:

20 (d)(a) substitutions T231R and N233R  
and

(d)(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  
25 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, 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,

30 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  
35 wherein z is from 2.0mm to 8.0mm,  
wherein the coating comprises the inorganic salt (b), and wherein the core comprises the deterative surfactant (a).

**[0009]** 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.

40 **[0010]** 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.

45 **[0011]** 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.

**[0012]** 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.

**[0013]** A suitable method for making the detergent particle is described in WO2010/122050.

50 **[0014]** 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.

**[0015]** The composition may comprise from 0.05wt% to 4.0wt% soil release polymer.

**[0016]** The composition may comprise from 0.1wt% to 3.0wt% carboxymethylcellulose (CMC).

55 **[0017]** The composition may comprise from 0.1wt% to 5.0wt% calcite.

**[0018]** The composition may comprise from 1wt% to 10wt% carboxylate polymer.

**[0019]** The composition may comprise less than 10wt% total level of silicates and aluminosilicates.

**[0020]** The composition may comprise from 0.001wt% to 0.5wt% hueing dye.

[0021] The composition may comprise from 0.001wt% to 0.5wt% organic pigment and/or inorganic pigment.

[0022] The composition may comprise from 0.2 wt% to 10wt% chelant, preferably phosphonate chelant.

[0023] The composition preferably comprises from 10wt% to 40wt% sodium carbonate.

5 [0024] **Deterstive surfactant:** A suitable deterstive surfactant system typically comprises at least 5% alcohol ether carboxylate as a percentage of the total deterstive surfactant system.

[0025] A suitable deterstive 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 deterstive surfactant system.

10 [0026] Preferably, the deterstive surfactant comprises C<sub>8</sub>-C<sub>24</sub> alkyl ethoxylated alcohol having an average degree of ethoxylation of from 20 to 50, and preferably the composition comprises from 1wt% to 10wt% C<sub>8</sub>-C<sub>24</sub> 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.

[0027] **Anionic deterstive surfactant:** Suitable anionic deterstive surfactants include sulphonate and sulphate deterstive surfactants.

15 [0028] Suitable sulphonate deterstive surfactants include methyl ester sulphonates, alpha olefin sulphonates, alkyl benzene sulphonates, especially alkyl benzene sulphonates, preferably C<sub>10-13</sub> 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®.

20 [0029] Suitable sulphate deterstive surfactants include alkyl sulphate, preferably C<sub>8-18</sub> alkyl sulphate, or predominantly C<sub>12</sub> alkyl sulphate.

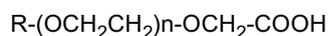
25 [0030] A preferred sulphate deterstive surfactant is alkyl alkoxyated sulphate, preferably alkyl ethoxylated sulphate, preferably a C<sub>8-18</sub> alkyl alkoxyated sulphate, preferably a C<sub>8-18</sub> alkyl ethoxylated sulphate, preferably the alkyl alkoxyated sulphate has an average degree of alkoxylation of from 0.5 to 20, preferably from 0.5 to 10, preferably the alkyl alkoxyated sulphate is a C<sub>8-18</sub> 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.

[0031] The alkyl sulphate, alkyl alkoxyated sulphate and alkyl benzene sulphonates may be linear or branched, substituted or un-substituted, and may be derived from petrochemical material or biomaterial.

[0032] Other suitable anionic deterstive surfactants include alkyl ether carboxylates.

30 [0033] Suitable anionic deterstive 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:



35 wherein,

R is selected from saturated and mono-unsaturated C<sub>10</sub> to C<sub>26</sub> linear or branched alkyl chains, preferably C<sub>12</sub> to C<sub>24</sub> linear or branched alkyl chains, most preferably a C<sub>16</sub> to C<sub>20</sub> linear alkyl chain;

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

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.

45 [0034] Suitable materials are sold under the AKYPO® (Kao) and Empicol® C (Huntsman) brand names.

50 [0035] **Non-ionic deterstive surfactant:** Suitable non-ionic deterstive surfactants are selected from the group consisting of: C<sub>8</sub>-C<sub>18</sub> alkyl ethoxylates, such as, NEODOL® non-ionic surfactants from Shell; C<sub>6</sub>-C<sub>12</sub> alkyl phenol alkoxyates wherein preferably the alkoxyate units are ethyleneoxy units, propyleneoxy units or a mixture thereof; C<sub>12</sub>-C<sub>18</sub> alcohol and C<sub>6</sub>-C<sub>12</sub> 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.

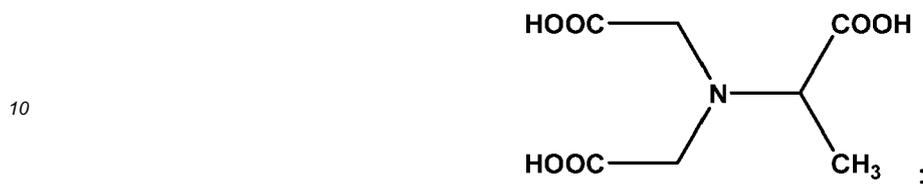
[0036] Suitable non-ionic deterstive surfactants are alkylpolyglucoside and/or an alkyl alkoxyated alcohol.

55 [0037] Suitable non-ionic deterstive surfactants include alkyl alkoxyated alcohols, preferably C<sub>8-18</sub> alkyl alkoxyated alcohol, preferably a C<sub>8-18</sub> alkyl ethoxylated alcohol, preferably the alkyl alkoxyated 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 alkoxyated alcohol is a C<sub>8-18</sub> 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 alkoxyated alcohol can be linear or branched, and substituted or un-substituted.

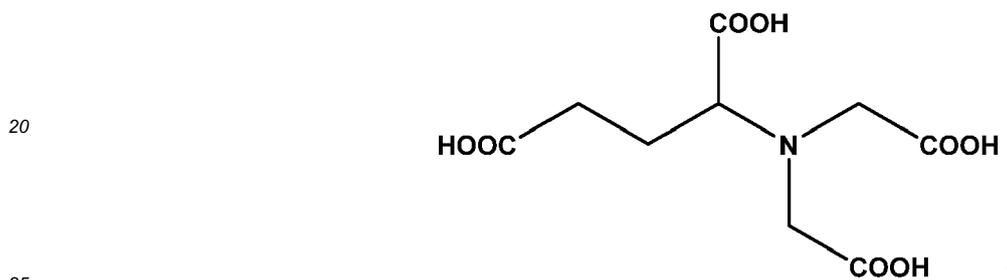
[0038] Suitable nonionic deterative surfactants include secondary alcohol-based deterative surfactants.

[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:

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

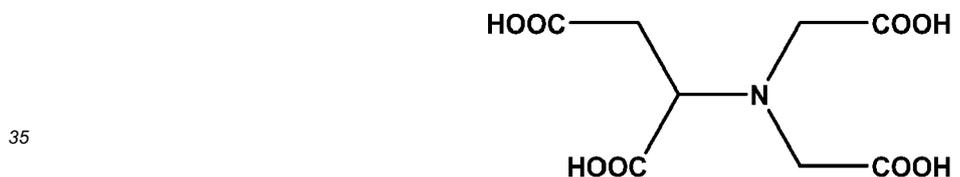


15 (ii) L-glutamic acid, N,N-diacetic acid and salts thereof (GLDA)

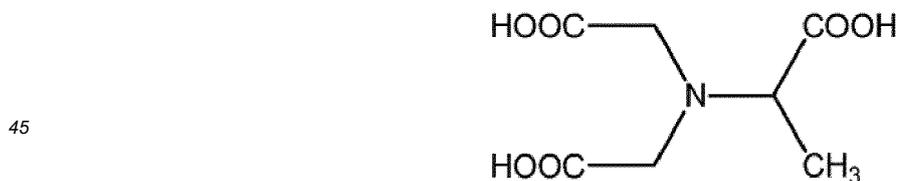


and

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



40 [0040] Preferably, the composition comprises from 0.1wt% to 10wt% methylglycinediacetic acid and salts thereof (MG-DA)

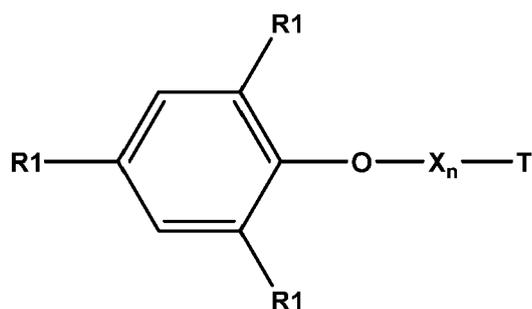


50 [0041] It may be preferred to formulate the amino acid derivative complexing agent in acid form. Alternatively, it may be preferred to formulate the amino acid derivative complexing agent in salt form, especially preferred is the sodium salt form.

[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.

55 [0043] **Alkoxylated polyaryl/polyalkyl phenol:** A suitable alkoxylated polyaryl/polyalkyl phenol has the following structure:

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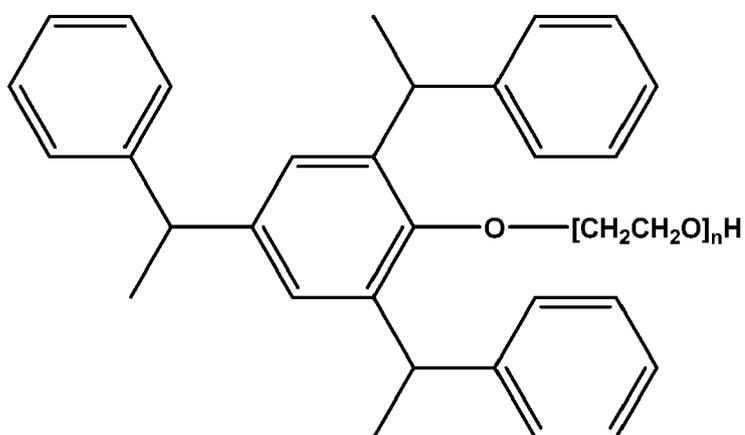
wherein  $R_1$  is selected from linear or branched  $C_3$ - $C_{15}$  alkyl groups and aryl groups, X is selected from ethoxy or propoxy groups, n is from 2 to 70, T is selected from H,  $SO_3^-$ ,  $COO^-$  and  $PO_3^{2-}$

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

(i) Uncharged alkoxyated tristyrylphenols of the following structure:

20



25

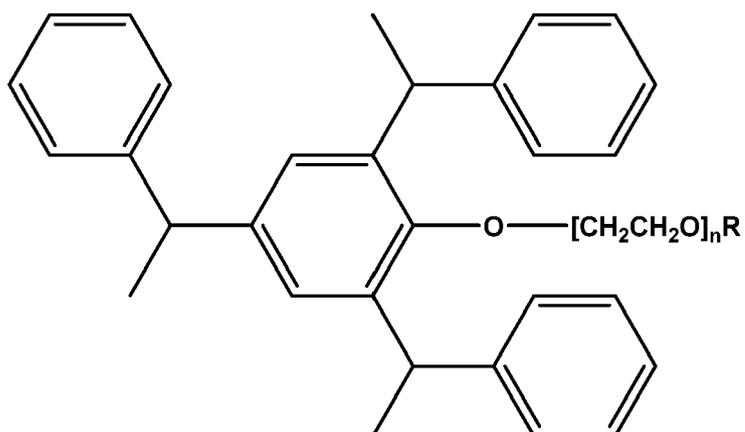
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wherein n is selected from 2 to 70, more preferably n is selected from 10 to 54, most preferably  $n = 16$  or  $20$ .

35

(ii) Anionic alkoxyated tristyrylphenols of the following structure

40



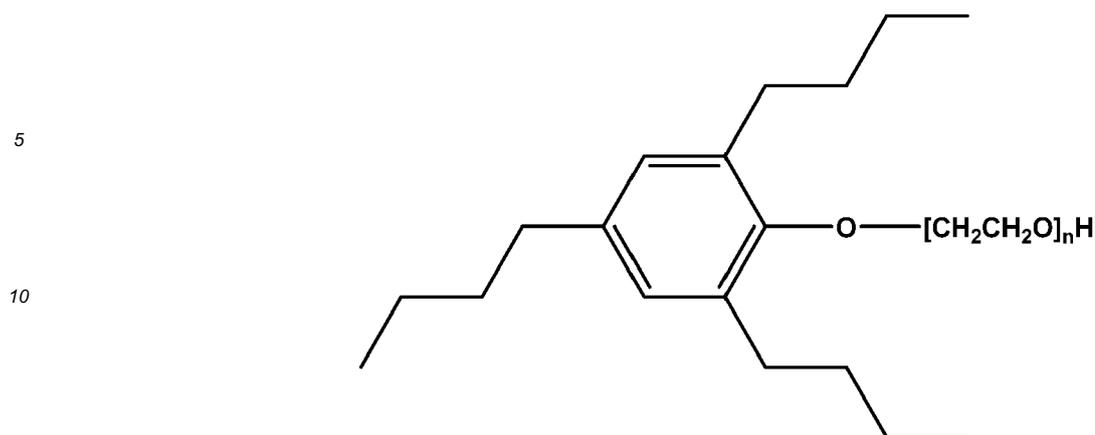
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50

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.

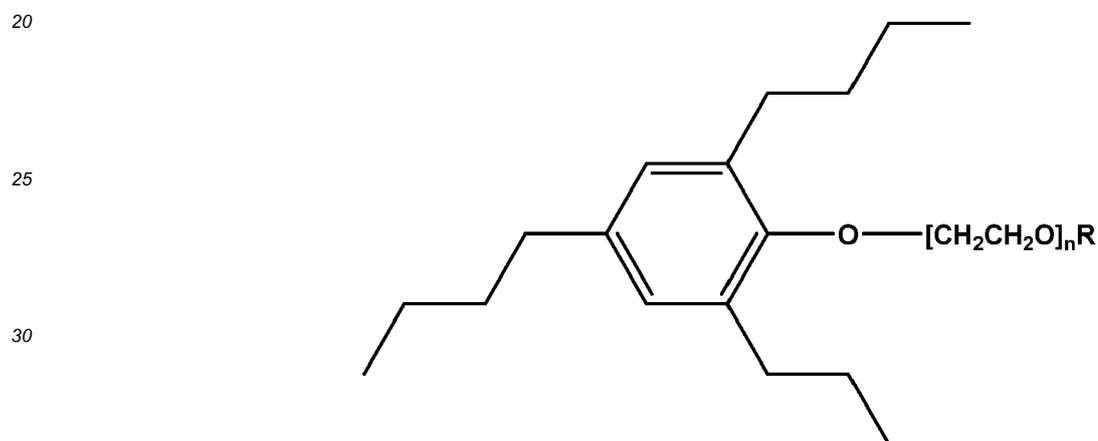
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(iii) Uncharged alkoxyated tri(n-butyl)phenols of the following structure:



wherein n is selected from 2 to 50

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



35 wherein R is selected from SO<sub>3</sub><sup>-</sup>, COO<sup>-</sup> and PO<sub>3</sub><sup>2-</sup>, preferably selected from SO<sub>3</sub><sup>-</sup> and COO<sup>-</sup>, wherein n is selected from 6 to 50.

40 **[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 alkoxyated polyaryl/polyalkyl phenol may be present at levels of 0.5-20wt%, preferably 1-15wt%, most preferably 3-10wt%.

45 **[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

50 (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,

55 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,

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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,

5 N128C;

Q129P;R;V;F;C;G;A;C;D;E;H;I;K;L;M;N;S;T;Y, particularly Q129E,

10 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,

15 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,

20 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;I;K;L;M;N;S;T;Y, particularly P211L;M;S;Q;G;V;W;A;H;T;R;

25 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,

30 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,

35 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,

40 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.

45 **[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.

50 **[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.

55 **[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*, *Nocardioidea*, *Xanthamonas*, *Micromonospora*, *Burkholderia*, *Dehalococcoides*, *Croceibacter*, *Kordia*, *Microscilla*, *Thermoactinomyces*, *Chloroflexus*, *Listeria*, *Plesiocystis*, *Halis-*

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comenobacter, *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) 1001L, 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,

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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, R011I, 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.

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[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 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'-disuccinic acid (EDDS) and/or alkali metal or ammonium salt thereof; 2-hydroxy propylene diamine-N,N'-disuccinic acid (HPDDS), and/or alkali metal or ammonium salt thereof; ethylenediamine-N,N'-diglutamic 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.

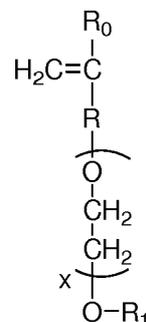
[0071] **Carboxylate polymer:** The composition may comprise a carboxylate polymer, such as a maleate/acrylate

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 contain 2-acrylamido-2-methyl-1-propanesulfonic acid, 2-methacrylamido-2-methyl-1-propanesulfonic acid, 3-methacrylamido-2-hydroxy-propanesulfonic acid, allylsulfonic acid, methallylsulfonic 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.

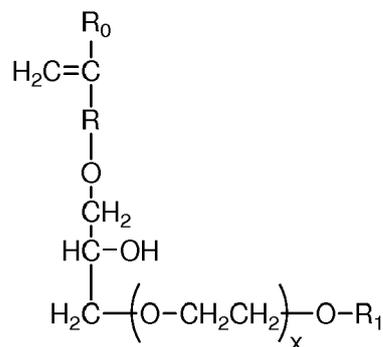
**[0073]** Another suitable carboxylate polymer is a co-polymer that comprises: (i) from 50 to less than 98 wt% structural units derived from one or more monomers comprising carboxyl groups; (ii) from 1 to less than 49 wt% structural units derived from one or more monomers comprising sulfonate moieties; 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):

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- (I)  $-\text{[(OCHR}^1\text{-CHR}^2\text{)}_a\text{-O-OC-Ar-CO-]}_d$
- (II)  $-\text{[(OCHR}^3\text{-CHR}^4\text{)}_b\text{-O-OC-sAr-CO-]}_e$
- (III)  $-\text{[(OCHR}^5\text{-CHR}^6\text{)}_c\text{-OR}^7\text{]}_f$

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  $\text{SO}_3\text{Me}$ ;

Me is Li, K, Mg/2, Ca/2, Al/3, ammonium, mono-, di-, tri-, or tetraalkylammonium wherein the alkyl groups are  $\text{C}_1\text{-C}_{18}$  alkyl or  $\text{C}_2\text{-C}_{10}$  hydroxyalkyl, or mixtures thereof;

$\text{R}^1$ ,  $\text{R}^2$ ,  $\text{R}^3$ ,  $\text{R}^4$ ,  $\text{R}^5$  and  $\text{R}^6$  are independently selected from H or  $\text{C}_1\text{-C}_{18}$  n- or iso-alkyl; and

$\text{R}^7$  is a linear or branched  $\text{C}_1\text{-C}_{18}$  alkyl, or a linear or branched  $\text{C}_2\text{-C}_{30}$  alkenyl, or a cycloalkyl group with 5 to 9 carbon atoms, or a  $\text{C}_8\text{-C}_{30}$  aryl group, or a  $\text{C}_6\text{-C}_{30}$  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:  $\text{C}_4\text{-C}_{25}$  alkyl group, polypropylene, polybutylene, vinyl ester of a saturated  $\text{C}_1\text{-C}_6$  mono-carboxylic acid,  $\text{C}_1\text{-C}_6$  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 mixtures 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] Alkoxyated polyalkyleneimine:** The composition may comprise an alkoxyated polyalkyleneimine, wherein said alkoxyated polyalkyleneimine has a polyalkyleneimine core with one or more side chains bonded to at least one nitrogen atom in the polyalkyleneimine core, wherein said alkoxyated polyalkyleneimine has an empirical formula (I) of  $(\text{PEI})_a\text{-(EO)}_b\text{-R}_1$ , wherein a is the average number-average molecular weight ( $\text{MW}_{\text{PEI}}$ ) of the polyalkyleneimine core of the alkoxyated 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 alkoxyated polyalkyleneimine and is in the range of from 5 to 40, and wherein  $\text{R}_1$  is independently selected from the group consisting of hydrogen,  $\text{C}_1\text{-C}_4$  alkyls, and combinations thereof.

**[0082]** The composition may comprise an alkoxyated polyalkyleneimine, wherein said alkoxyated polyalkyleneimine

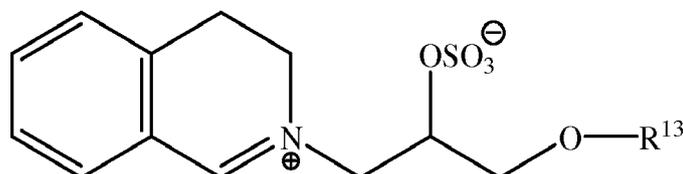
has a polyalkyleneimine core with one or more side chains bonded to at least one nitrogen atom in the polyalkyleneimine core, wherein the alkoxyated polyalkyleneimine has an empirical formula (II) of  $(PEI)_o-(EO)_m(PO)_n-R_2$  or  $(PEI)_o-(PO)_n(EO)_m-R_2$ , wherein  $o$  is the average number-average molecular weight ( $MW_{PEI}$ ) of the polyalkyleneimine core of the alkoxyated 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 alkoxyated polyalkyleneimine which ranges from 10 to 50, wherein  $n$  is the average degree of propoxylation in said one or more side chains of the alkoxyated 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, transition 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-pentylononyl, 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 following 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, Optimize® 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 WO10/05665.

**[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: Lip1 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:

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

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

Preferred brighteners are: sodium 2 (4-styryl-3-sulfophenyl)-2H-naphthol[1,2-d]triazole, disodium 4,4'-bis[[4-anilino-6-(N-methyl-N-2-hydroxyethyl)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 alkoxyated. Such alkoxyated 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 alkoxyated bis-azo dyes, such as described in WO2012/054835, and/or alkoxyated 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

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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:

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

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  $\pm$  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  $\pm$ 0.01pH units, with stirring, ensuring temperature is 20°C  $\pm$  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

#### [0111]

##### Illustrative Example

Ingredient	Amount (in wt%)
<b>Anionic detergent surfactant</b> (such as alkyl benzene sulphonate, alkyl ethoxylated sulphate, alkyl ether carboxylic acid, and mixtures thereof)	from 15wt% to 35wt%
<b>Non-ionic detergent surfactant</b> (such as alkyl ethoxylated alcohol)	from 0.1wt% to 5wt%
<b>Carboxylate polymer</b> (such as co-polymers of maleic acid and acrylic acid and/or carboxylate polymers comprising ether moieties and sulfonate moieties)	from 0wt% to 4wt%
<b>Polyethylene glycol polymer</b> (such as a polyethylene glycol polymer comprising polyvinyl acetate side chains)	from 0wt% to 4wt%
<b>Polyester soil release polymer</b> (such as Repel-o-tex and/or Texcare polymers)	from 0wt% to 2wt%
<b>Cellulosic polymer</b> (such as carboxymethyl cellulose, methyl cellulose and combinations thereof)	from 0wt% to 2wt%
<b>Other polymer</b> (such as care polymers)	from 0wt% to 4wt%
<b>Citric acid and/or sodium citrate</b>	from 10wt% to 40wt%
<b>Inorganic salts</b> (such as sodium carbonate, sodium sesquicarbonate, sodium bicarbonate and combinations thereof)	from 10wt% to 40wt%
<b>Amino acid derivative complexing agent</b> (such as MGDA, GLDA, ASDA and combination thereof)	from 0.1wt% to 40wt%

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(continued)

Ingredient	Amount (in wt%)
Amylase	from 0.001wt% to 0.1wt%
Metalloprotease (such as a M4 metalloprotease)	from 0.001wt% to 0.1wt%
Lipase	from 0.001wt% 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%
Alkoxyated polyaryl/polyalkyl phenol	from 0.5wt% to 20wt%
Hueing dye	from 0.001wt% 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."

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SEQUENCE LISTING

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15  
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5 Ala Leu Thr Val Tyr Leu Thr Pro Ser Ser Thr Phe Lys Asp Ala Lys  
 260 265 270

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

15 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% deterative surfactant selected from anionic deterative surfactant and/or non-ionic deterative 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% lipase that is a variant of SEQ ID NO:2 comprising:

(d)(a) substitutions T231R and N233R  
 and

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

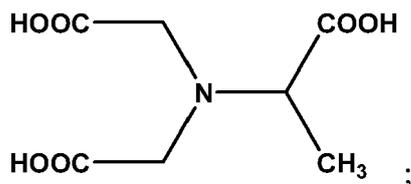
where the positions correspond to the positions of SEQ ID NO 2 and wherein the lipase variant has at least 95% but less than 100% sequence identity to the polypeptide having the amino acid sequence of SEQ ID NO: 2 and wherein the variant has lipase activity,  
 wherein at 1wt% dilution in de-ionised 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 deterative surfactant (a).

2. A composition according to claim 1, wherein the composition comprises from 0.001wt% to 1.0wt% metalloprotease enzyme.

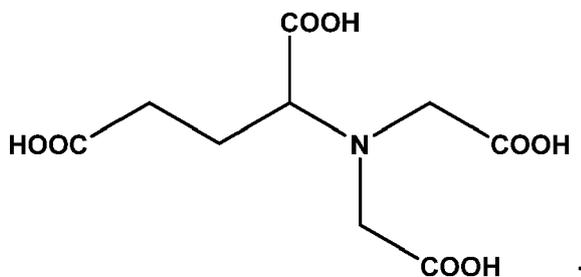
3. A composition according to any preceding claim, wherein the composition comprises from 0.1wt% to 40wt% amino acid derivative complexing agent selected from one or more of the following, in any stereoisomer or mixture of stereoisomer form:

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

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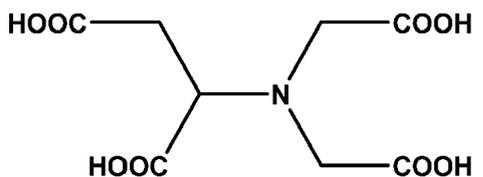


(3)(ii) L-glutamic acid, N,N-diacetic acid and salts thereof (GLDA)



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;A;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;A;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;I;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,

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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,

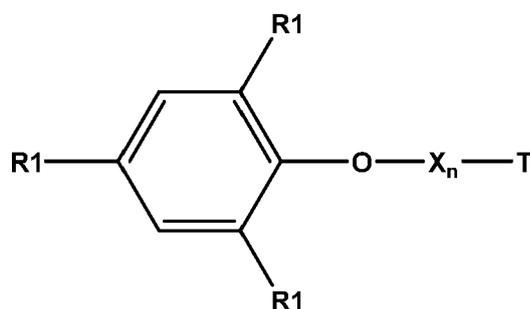
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where the positions correspond to the positions of SEQ ID NO 1 and wherein the amylase variant has at least 95%, such as at least 96%, or at least 97%, or at least 98%, or at least 99% but less than 100% sequence identity to the polypeptide having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

10 5. A composition according to any preceding claim, wherein the composition comprises a metalloprotease enzyme that is selected from the M4 Metalloprotease Family.

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:

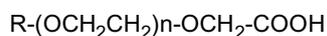
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wherein R<sub>1</sub> is selected from linear or branched C<sub>3</sub>-C<sub>15</sub> alkyl groups and aryl groups, X is selected from ethoxy or propoxy groups, n is from 2 to 70, T is selected from H, SO<sub>3</sub><sup>-</sup>, COO<sup>-</sup> and PO<sub>3</sub><sup>2-</sup>.

30 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:



35 wherein,

R is selected from saturated and mono-unsaturated C<sub>10</sub> to C<sub>26</sub> linear or branched alkyl chains, and n is selected from 5 to 20.

40 8. A composition according to any preceding claim, wherein the detergent surfactant comprises from C<sub>8</sub>-C<sub>24</sub> alkyl ethoxylated alcohol having an average degree of ethoxylation of from 20 to 50, and wherein the composition comprises from 1wt% to 10wt% C<sub>8</sub>-C<sub>24</sub> alkyl ethoxylated alcohol having an average degree of ethoxylation of from 20 to 50.

45 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).

50 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.

55 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.

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

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

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EUROPEAN SEARCH REPORT

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