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(54) **DETERGENT COMPOSITION COMPRISING ENZYMES**

(57) The present invention relates to a detergent composition comprising at least one protease, at least one amylase and at least one cellulase in specific amounts and ratios. Furthermore, the present invention relates to a method for preventing or removing greying of a fabric comprising contacting said fabric with a composition comprising at least one cellulase, at least one protease and at least one amylase, and to the use of at least one cellulase in combination with at least one protease and at least one amylase for preventing or removing greying of a fabric.

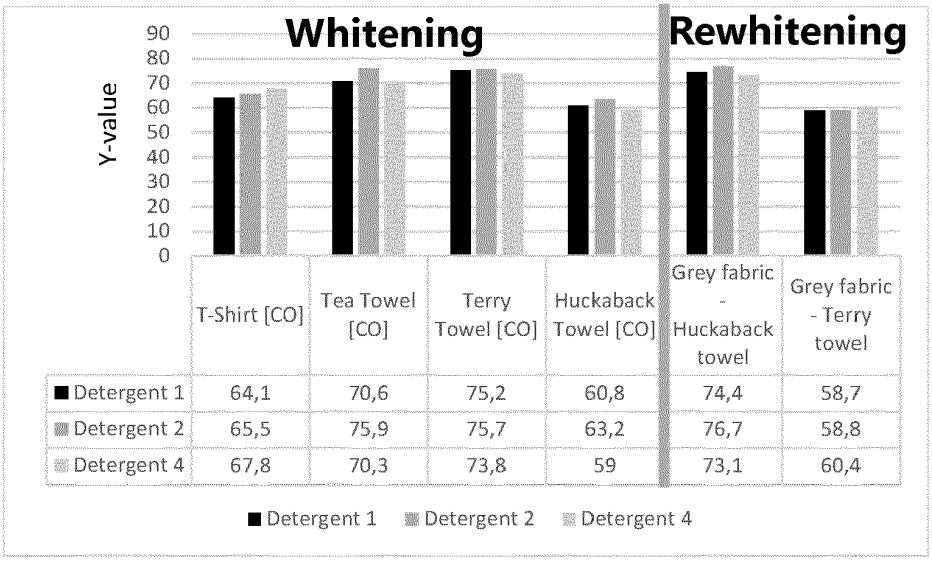

Fig. 1

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Description

[0001] The present invention relates to a detergent composition comprising at least one protease, at least one amylase and at least one cellulase in specific amounts and ratios. Furthermore, the present invention relates to a method for preventing or removing greying of a fabric comprising contacting said fabric with a composition comprising at least one cellulase, at least one protease and at least one amylase, and to the use of at least one cellulase in combination with at least one protease and at least one amylase for preventing or removing greying of a fabric.

[0002] Consumers want to maintain the whiteness of their fabrics and not face dull clothes after wearing and washing. To prevent this, additives like bleach are added to detergents or optical brighteners are used in soaking steps. However, additional washing steps are often undesirable, because they are time-consuming for the consumers and also mean that the consumer is taken out of the one-stop-ecosystem of a manufacturer's detergent.

[0003] Adding anti-greying cellulase to a detergent such as a liquid detergent is well known. However, it is also known that components of a detergent composition can interact with each other and, thus, have a negative impact on the anti-greying or washing performance of the detergent.

[0004] Therefore, there is need in the art for detergent formulations comprising enzymes that counteract these negative interactions between components of the composition.

[0005] Surprisingly, it has been found that optimizing the enzyme concentrations and the levels of enzyme ratios in a detergent composition, in particular the protease concentration and its ratio to the cellulase, increases the anti-greying and whitening efficiency caused by cellulases, while maintaining the washing performance.

[0006] Thus, in a first aspect, the present invention relates to a detergent composition, preferably liquid laundry detergent compositions, comprising

a) at least one protease in an amount of from 0.001 to 0.1 wt.-%,
b) at least one amylase in an amount of from 0.0001 to 0.01 wt.-%, and
c) at least one cellulase in an amount of from 0.0001 to 0.01 wt.-%,

each based on the active protein content and the total weight of the detergent composition, wherein the weight ratio of the amount of protease to cellulase is in the range of from 97:3 to 80:20; the weight ratio of the amount of protease to amylase is in the range of from 95:5 to 75:25;
and the weight ratio of the amount of amylase to cellulase is in the range of from 80:20 to 60:40.

[0007] In a second aspect, the present invention relates to a method for preventing or removing greying of a fabric, comprising contacting said fabric with a composition comprising at least one cellulase, at least one protease and at least one amylase and, optionally, at least one lipase, wherein the detergent composition is a composition according to the present invention, in particular during a washing process.

[0008] The present invention further relates to the use of at least one cellulase in combination with at least one protease and at least one amylase and, optionally, at least one lipase for preventing or removing greying of a fabric, preferably in a washing process, wherein the enzymes are comprised in a detergent composition according to the present invention.

[0009] These and other aspects, embodiments, features, and advantages of the invention become apparent to the person skilled in the art in the following detailed description and claims. Each feature from one aspect of the invention can be used in any other aspect of the invention. Furthermore, the examples contained herein are intended to describe and illustrate the invention, but do not restrict it. In particular, the invention is not limited to these examples.

[0010] "At least one", as used herein, means one or more, i.e. 1, 2, 3, 4, 5, 6, 7, 8, 9 or more of the referenced species. Similarly, "one or more", as used herein, relates to at least one and comprises 1, 2, 3, 4, 5, 6, 7, 8, 9 or more. In connection with a given species, the term does not relate to the total number of molecules, but rather to the type of species. "At least one protease", for example, thus means that one type of protease or two or more different types of proteases may be present. In connection with amounts, the term relates to the total amount of the referenced species. In case of proteases, for example, this means that the given amount is the total amount of all proteases in the composition.

[0011] Numeric values specified without decimal places here refer to the full value specified with one decimal place, i.e. for example, 99 % means 99.0 %, unless otherwise defined.

[0012] The terms "about", "approximately" or "approx.", in connection with a numerical value, refer to a variance of ±10 %, preferably ±5 %, with respect to the given numerical value.

[0013] The term "essentially free" within the context of this invention is to be interpreted as the respective compound is contained in the composition in an amount of less than 5 wt.-%, 4 wt.-%, 3 wt.-%, 2 wt.-%, 1.5 wt.-%, 1 wt.-%, 0.75 wt.-%, 0.5 wt.-%, 0.25 wt.-%, 0.1 wt.-%, 0.01 wt.-%, or 0.001 wt.-% based on the total weight of the composition, wherein the amounts are respectively more preferred in descending order. For example, 4 wt.-% is more preferred than 5 wt.-% and 3 wt.-% is more preferred than 4 wt.-%.

[0014] All percentages given herein in relation to the compositions or formulations relate to weight % (wt.-%) relative to the total weight of the respective composition or formula, if not explicitly stated otherwise. Numeric ranges specified

in the format "from x to y" include the specified values. If multiple preferred numeric ranges are specified in this format, it is understood that all ranges created by combining the different endpoints are also included.

[0015] "Variant," as used herein, refers to natural or artificially produced variations of a native enzyme/protein that has a modified amino acid sequence relative to the reference form.

[0016] According to the present invention, provided herein is a detergent composition comprising

a) at least one protease in an amount of from 0.001 to 0.1 wt.-%,
b) at least one amylase in an amount of from 0.0001 to 0.01 wt.-%, and
c) at least one cellulase in an amount of from 0.0001 to 0.01 wt.-%,

each based on the active protein content and the total weight of the detergent composition, wherein the weight ratio of the amount of protease to cellulase is in the range of from 97:3 to 80:20; the weight ratio of the amount of protease to amylase is in the range of from 95:5 to 75:25;
and the weight ratio of the amount of amylase to cellulase is in the range of from 80:20 to 60:40.

[0017] "Detergent compositions" according to the present invention comprise all conceivable textile washing and/or care compositions used in the washing machine or in hand washing. This includes, for example, detergent compositions and compositions for cleaning, care and/or conditioning, pre- and/or posttreatment of all types of textiles, such as garments, carpets, and textile furniture surfaces.

[0018] In various embodiments, the present invention is a laundry detergent composition, preferably a liquid laundry detergent composition.

[0019] The term "liquid", as used herein, refers to compositions that are flowable and pourable at standard conditions (20 °C and 1013 mbar). Liquid compositions can also comprise gel-like and paste-like compositions. In particular, non-newtonian liquids are comprised as well.

[0020] However, in various embodiments, it is not excluded that the detergent composition is a solid or powdery detergent composition, e.g., a powder, extrudate, granules, or tablet.

[0021] In preferred embodiments, the composition further comprises d) at least one lipase.

[0022] Thus, in various embodiment, the detergent composition comprises

a) at least one protease in an amount of from 0.001 to 0.1 wt.-%,
b) at least one amylase in an amount of from 0.0001 to 0.01 wt.-%,
c) at least one cellulase in an amount of from 0.0001 to 0.01 wt.-%, and
d) at least one lipase in an amount of from 0.0001 to 0.1 wt.-%,

each based on the active protein content and the total weight of the detergent composition, wherein the weight ratio of the amount of protease to cellulase is in the range of from 97:3 to 80:20; the weight ratio of the amount of protease to amylase is in the range of from 95:5 to 75:25;
and the weight ratio of the amount of amylase to cellulase is in the range of from 80:20 to 60:40.

[0023] In various embodiments, the composition comprises

a) the at least one protease in an amount of from 0.001 to 0.05 wt.-%, preferably 0.001 to 0.03 wt.-%, more preferably 0.005 to 0.029 wt.-%, more preferably 0.01 to 0.026 wt.-%, for example equal to or less than 0.024 wt.-%, most preferably 0.01 to 0.023 wt.-%, for example equal to or less than 0.02 wt.-% or equal to or less than 0.018 wt.-%; and/or
b) the at least one amylase in an amount of from 0.0001 to 0.005 wt.-%, preferably 0.001 to 0.005 wt.- %, more preferably 0.001 to 0.004 wt.-%, for example equal to or less than 0.0034 wt.-%, most preferably 0.001 to 0.0033 wt.-%, for example equal to or less than 0.003 wt.-% or equal to or less than 0.0028 wt.-%; and/or
c) the at least one cellulase in an amount of from 0.0001 to 0.008 wt.-%, preferably 0.0001 to 0.003 wt.- %, more preferably 0.0005 to 0.0025 wt.-%, for example 0.0006 to 0.002 wt.-% or 0.0006 to 0.0015 wt.- %; and/or
d) optionally the at least one lipase in an amount of from 0.0001 to 0.1 wt.-%, preferably 0.0005 to 0.01 wt.-%, more preferably 0.001 to 0.01 wt.-%, for example equal to or more than 0.003 wt.-% or equal to or more than 0.0033 wt.-% or equal to or more than 0.004 wt.-%, most preferably 0.0033 to 0.008 wt.- %;

each based on the active protein content and the total weight of the detergent composition.

[0024] It is further preferred that the composition comprises

i) higher levels of protease than cellulase; and/or
ii) higher levels of protease than lipase; and/or
iii) higher levels of protease than amylase; and/or
iv) higher levels of amylase than cellulase; and/or

v) higher levels of lipase than amylase; and/or
vi) higher levels of lipase than cellulase; and/or
vii) higher levels of protease, amylase and/or lipase than cellulase; and/or
viii) higher levels of protease than amylase, cellulase and, optionally, lipase;

each based on the active protein content and the total weight of the detergent composition.

[0025] In various embodiments, the composition comprises

i) the at least one protease and the at least one cellulase in a weight ratio of 96:4 to 85:15, preferably 95:5 to 88:12, more preferably 95:5 to 90:10, most preferably 95:5 to 92:8, based on the active protein content of the at least one protease and the at least one cellulase in the detergent composition; and/or
ii) the at least one amylase and the at least one cellulase in a weight ratio of 78:22 to 65:35, preferably 77:23 to 68:32, more preferably 76:24 to 70:30, most preferably 76:24 to 72:28, based on the active protein content of the at least one amylase and the at least one cellulase in the detergent composition; and/or
iii) the at least one protease and the at least one amylase in a weight ratio of 90:10 to 80:20, preferably 88:12 to 81:19, most preferably 86:14 to 82:18, based on the active protein content of the at least one protease and the at least one amylase in the detergent composition; and/or
iv) the at least one protease and amylase together and the at least one cellulase in a weight ratio of 99.9:0.1 to 70:30, preferably 99:1 to 75:25, more preferably 98:2 to 80:20, more preferably 98:2 to 85:1, more preferably 97:3 to 90:10, most preferably 96:4 to 91:9, based on the active protein content of the at least one protease and the at least one amylase together and the at least one cellulase in the detergent composition; and/or
v) the at least one protease and cellulase together and the at least one amylase in a weight ratio of 99.9:0.1 to 60:40, preferably 99:1 to 70:30, more preferably 95:5 to 75:25, more preferably 90:10 to 78:22, most preferably 88:12 to 80:20, based on the active protein content of the at least one protease and the at least one cellulase together and the at least one amylase in the detergent composition; and/or
vi) the at least one protease and the at least one amylase and cellulase together in a weight ratio of 99:1 to 60:40, preferably 95:5 to 65:35, more preferably 90:10 to 70:30, more preferably 87:13 to 73:27, most preferably 84:16 to 75:25, based on the active protein content of the at least one protease and the at least one cellulase and amylase together in the detergent composition; and/or
vii) optionally the at least one lipase and the at least one cellulase in a weight ratio of 99.9:0.1 to 60:40, preferably 99:1 to 65:35, more preferably 95:5 to 70:30, more preferably 93:7 to 75:25 wt.-%, more preferably 90:10 to 78:22, more preferably 89:11 to 80:20, most preferably 89:11 to 82:18, based on the active protein content of the at least one lipase and the at least one cellulase in the detergent composition; and/or
viii) optionally the at least one protease and the at least one lipase in a weight ratio of 99:1 to 50:50; preferably 95:5 to 55:45; more preferably 90:10 to 60:40, more preferably 85:15 to 60:40, more preferably 80:20 to 60:40, more preferably 77:23 to 65:35, most preferably 75:25 to 67:33, based on the active protein content of the at least one protease and the at least one lipase in the detergent composition; and/or
ix) optionally the at least one lipase and the at least one amylase in a weight ratio of 99:1 to 50:50; preferably 95:5 to 55:45, more preferably 90:10 to 55:45, more preferably 85:15 to 55:45, more preferably 80:20 to 55:45, more preferably 75:25 to 60:40, most preferably 73:27 to 62:38, based on the active protein content of the at least one lipase and the at least one amylase in the detergent composition; and/or
x) optionally the at least one protease and the at least one lipase together and the at least one cellulase in a weight ratio of 99.99:0.01 to 70:30, preferably 99.9:0.1 to 75:25, more preferably 99.5:0.5 to 80:20, more preferably 99.1:0.9 to 85:15, most preferably 99:1 to 90:10, based on the active protein content of the at least one protease and the at least one lipase together and the at least one cellulase in the detergent composition; and/or
xi) optionally the at least one amylase and the at least one lipase together and the at least one cellulase in a weight ratio of 99.99:0.01 to 70:30, preferably 99.9:0.1 to 75:25, more preferably 99.5:0.5 to 80:20, more preferably 99:1 to 82:18, most preferably 95:5 to 84:16, based on the active protein content of the at least one amylase and the at least one lipase together and the at least one cellulase in the detergent composition; and/or
xii) optionally the at least one protease and the at least one cellulase together and the at least one lipase in a weight ratio of 99:1 to 50:50, preferably 95:5 to 60:40, more preferably 90:10 to 65:35, more preferably 85:15 to 65:35, more preferably 80:20 to 65:35, most preferably 78:22 to 69:31, based on the active protein content of the at least one protease and the at least one cellulase together and the at least one lipase in the detergent composition; and/or
xiii) optionally the at least one lipase and the at least one amylase and cellulase together in a weight ratio of 80:20 to 40:60, preferably 75:25 to 50:50, more preferably 70:30 to 52:48, most preferably 65:35 to 55:45, based on the active protein content of the at least one lipase and the at least one amylase and cellulase together in the detergent composition; and/or
xiv) optionally the at least one protease, amylase and lipase together and the at least one cellulase in a weight ratio

of 99.99:0.01 to 80:20, preferably 99.9:0.1 to 85:15, more preferably 99:1 to 88:12, more preferably 98:2 to 90:10, most preferably 97:3 to 92:8, based on the active protein content of the at least one protease, the at least one amylase and the at least one lipase together and the at least one cellulase in the detergent composition; and/or

xv) optionally the at least one protease and the at least one cellulase, amylase and lipase together in a weight ratio of 80:20 to 40:60, preferably 75:25 to 50:50, more preferably 70:30 to 50:50, more preferably 65:35 to 58:42, most preferably 63:35 to 58:42, based on the active protein content of the at least one protease and the at least one amylase, lipase and cellulase together in the detergent composition; and/or

xvi) optionally the at least one protease, lipase and cellulase together and the at least one amylase in a weight ratio of 99.9:0.1 to 60:40, preferably 99:1 to 70:30, more preferably 98:2 to 75:25, more preferably 95:5 to 78:22, most preferably 93:7 to 82:18, based on the active protein content of the at least one protease, lipase and cellulase together and the at least one amylase in the detergent composition; and/or

xvii) optionally the at least one protease, amylase and cellulase together and the at least one lipase in a weight ratio of 95:5 to 50:50, preferably 90:10 to 60:40, more preferably 85:15 to 65:35, more preferably 80:20 to 70:30, most preferably 80:20 to 73:27, based on the active protein content of the at least one protease, amylase and cellulase together and the at least one lipase in the detergent composition.

[0026] In preferred embodiments,

i) the weight ratio of the amount of protease to amylase is in the range of from 86:14 to 82:18, the weight ratio of the amount of protease to cellulase is in the range of from 95:5 to 90:10 and the weight ratio of the amount of amylase to cellulase is in the range of from 76:24 to 70:30; and, optionally,

ii) the weight ratio of the amount of protease to amylase is in the range of from 86:14 to 82:18, the weight ratio of the amount of protease to cellulase is in the range of from 95:5 to 90:10 and the weight ratio of the amount of amylase to cellulase is in the range of from 76:24 to 70:30, the weight ratio of the amount of lipase to cellulase is in the range of from 89:11 to 80:20, the weight ratio of the amount of lipase to protease is in the range of from 78:22 to 65:35, and the weight ratio of the amount of lipase to amylase is in the range of from 72:28 to 65:35; and/or

iii) the composition comprises the at least one protease in an amount of less than 0.024 wt.-%, preferably of from 0.01 to 0.023 wt.-%, the at least one amylase in an amount of less than 0.0034 wt.-%, preferably of from 0.001 to 0.0033 wt.-%, and the at least one cellulase in an amount of from 0.0005 to 0.0025 wt.- %, preferably 0.0006 to 0.002 wt.-%, and, optionally, the at least one lipase in an amount of equal to or more than 0.0033 wt.-%, most preferably 0.0033 to 0.008 wt.-%;

each based on the active protein content and the total weight of the detergent composition.

[0027] In preferred embodiments, the amount of protease in the detergent composition is reduced to equal to or less than 0.024 wt.-%, most preferably to 0.01 to 0.023 wt.-%, for example equal to or less than 0.02 wt.-% or equal to or less than 0.018 wt.-% or equal to or less than 0.015 wt.-%, based on the active protein content and the total weight of the detergent composition. In particular, the reduction of the protease concentration in the detergent composition is helpful to reduce (detrimental) interactions between proteases and cellulases to increase the anti-greying and whitening activity of the detergent composition. Preferably, the reduction of the protease concentration can also reduce interactions between the protease and further constituents of the detergent composition such as further enzymes different from cellulases, for example lipases and/or amylases.

[0028] Preferably, proteases used in the detergent composition according to the invention exhibit enzymatic activity, i.e. they are capable of hydrolyzing peptides and proteins. A protease as used according to the invention is therefore an enzyme which catalyzes the hydrolysis of amide/peptide bonds in protein/peptide substrates and is thus able to cleave proteins or peptides. Furthermore, the protease is preferably a mature protease, i.e. the catalytically active molecule without signal peptide(s) and/or propeptide(s). Unless stated otherwise, the sequences given also refer to mature (processed) enzymes.

[0029] In various embodiments of the invention, the protease is a free enzyme. This means that the protease can act directly with all the components of a composition and, if the composition is a liquid composition, that the protease is in direct contact with the solvent of the composition (e.g. water). In other embodiments, a composition may contain proteases that form an interaction complex with other molecules or that contain a "coating." In this case, an individual protease molecule or multiple protease molecules may be separated from the other constituents of the composition by a surrounding structure. Such a separating structure may be formed from, but is not limited to, vesicles such as a micelle or a liposome. The surrounding structure may also be a virus particle, a bacterial cell or a eukaryotic cell. In various embodiments, a composition may include cells of *Bacillus pumilus* or *Bacillus subtilis* which express the proteases, or cell culture supernatants of such cells.

[0030] Examples of the proteases that can be used in detergent compositions as described herein are the subtilisins BPN' from *Bacillus amyloliquefaciens* and Carlsberg from *Bacillus licheniformis*, the protease PB92, the subtilisins 147

and 309, the protease from *Bacillus lentus,* in particular from *Bacillus lentus* DSM 5483, subtilisin DY and the enzymes thermitase, proteinase K and the proteases TW3 and TW7, without being limited to it. Subtilisin Carlsberg is available in a further developed form under the trade name Alcalase® from the company Novozymes. Subtilisins 147 and 309 are marketed by Novozymes under the trade names Esperase® and Savinase®, respectively. Protease variants are derived from the protease from *Bacillus lentus* DSM 5483. Other useful proteases are, for example, those marketed under the trade names Durazym®, Relase®, Everlase®, Nafizym®, Natalase®, Kannase®, Progress Uno 101L® and Ovozyme® from Novozymes, those marketed under the names Purafect®, Purafect® OxP, Purafect® Prime, Excellase®, Properase®, Preferenz P100® and Preferenz P300® from Danisco/DuPont, Lavergy pro 104 LS® from the company BASF, Protosol® from Advanced Biochemicals Ltd., Wuxi® from the company Wuxi Snyder Bioproducts Ltd., Proleather® and Protease P® from Amano Pharmaceuticals Ltd., and Proteinase K-16 from the company Kao Corp. Preferred proteases are the proteases from *Bacillus gibsonii* and *Bacillus pumilus* that are disclosed in WO 2008/086916, WO 2007/131656, WO 2017/215925, WO 2021/175696 and WO 2021/175697, for example. Further preferred usable proteases are those disclosed in WO 91/02792, WO 2008/007319, WO 93/18140, WO 01/44452, GB 1243784 A, WO 96/34946, WO 02/029024 and WO 03/057246, for example. Other usable proteases are those naturally present in the microorganisms *Stenotrophomonas maltophilia,* in particular *Stenotrophomonas maltophilia* K279a, *Bacillus intermedius* as well as *Bacillus sphaericus.* Proteases can also be altered, selectively or randomly, by methods known from the prior art, and can thereby be optimized for use in detergent compositions, for example. These methods include, for example, point, deletion or insertion mutagenesis, or fusion with other proteins or protein parts. Thus, protease variants can also be used in the detergent compositions according to the invention.

[0031] In various embodiments, the at least one protease is a protease originated from *Bacillus lentus* or a variant thereof.

[0032] In preferred embodiments, the at least one protease is an enzyme with proteolytic activity and comprises an amino acid sequence having at least 70%, preferably at least 71%, 72%, 73%, 74%, 75%, 76%, 77%, 78%, or 79%, more preferably at least 80%, 81%, 82%, 83%, 84%, 85%, 86%, 87%, 88% or 89%, more preferably at least 90%, 90.5%, 91%, 91.5%, 92%, 92.5%, 93%, 93.5%, 94%, 94.5%, 95%, 95.5%, 96%, 96.5%, 97%, 97.5%, 98%, 98.4%, 98.5%, 98.6%, 98.7% or 98.8% sequence identity to the amino acid sequence set forth in SEQ ID NO:1 over the total length, wherein the amino acid sequence comprises at least one, preferably at least two, more preferably at least three or most preferably four, amino acid substitutions at at least one, preferably at at least two, more preferably at at least three or most preferably at four, of the positions corresponding to positions 3, 4, 99 and 199 based on the numbering of SEQ ID NO:1 over its total length. Preferably the at least one, more preferably at least two, more preferably at least three, most preferably four amino acid substitutions, are selected from S3T, V4I, R99E/D and V199I, preferably S3T, V4I, R99E and V199I, based on the numbering of SEQ ID NO:1 over its total length.

[0033] In various embodiments, a further amino acid substitution can be present at position 211 based on the numbering of SEQ ID NO:1 over its total length, preferably the amino acid substitution is 211L.

[0034] In various embodiments, the at least one protease of the detergent composition according to the invention comprises or consists of an amino acid sequence having at least 70%, preferably at least 71%, 72%, 73%, 74%, 75%, 76%, 77%, 78% or 79%, more preferably at least 80%, 81%, 82%, 83%, 84%, 85%, 86%, 87%, 88% or 89%, more preferably at least 90%, 90.5%, 91%, 91.5%, 92%, 92.5%, 93%, 93.5%, 94%, 94.5%, 95%, 95.5%, 96%, 96.5%, 97%, 97.5%, 98%, 98.4%, 98.5%, 98.6%, 98.7% or 98.8% sequence identity to the amino acid sequence set forth in SEQ ID NO: 1 over its total length, wherein the amino acid sequence comprises

(i) at at least three or preferably at four of the positions, corresponding to positions 3, 4, 99 or 199 at least three or preferably four amino acid substitution, preferably selected from S3T, V4I, R99E and V199I; and, optionally,
(ii) at at least one of the positions corresponding to positions 74, 136, 143, 154, 160, 161, 163, 171, 181, 183, 185, 200, 203, 209, 212 or 256 at least one further amino acid substitution, in particular selected from N74D/E/Q, A136Q, R143L/W/Y, S154D/Q, S160G, Y161T, A163G, V171L, A181D, F183R, Q185R, Q200A/L/S/T, Y203K/V/W, A209K/W, N212S/T and L256D/E/Q, preferably selected from S154D, S160G, A181D, F183R, Q185R, Q200L, Y203W, A209K and L256E. In particular at least two, at least three, at least four or at least five further amino acid substitutions selected from N74D/E/Q, A136Q, R143L/W/Y, S154D/Q, S160G, Y161T, A163G, V171L, A181D, F183R, Q185R, Q200A/L/S/T, Y203K/V/W, A209K/W, N212S/T and L256D/E/Q, preferably selected from S154D, S160G, A181D, F183R, Q185R, Q200L, Y203W, A209K and L256E,

based on the numbering of SEQ ID NO:1 over its total length.

[0035] In preferred embodiments, the at least one protease of the detergent composition according to the invention comprises or consists of an amino acid sequence having at least 70%, preferably at least 71%, 72%, 73%, 74%, 75%, 76%, 77%, 78% or 79%, more preferably at least 80%, 81%, 82%, 83%, 84%, 85%, 86%, 87%, 88% or 89%, more preferably at least 90%, 90.5%, 91%, 91.5%, 92%, 92.5%, 93%, 93.5%, 94%, 94.5%, 95%, 95.5%, 96%, 96.5%, 97%, 97.5%, 98%, 98.4%, 98.5%, 98.6%, 98.7% or 98.8% sequence identity to the amino acid sequence set forth in SEQ ID

NO: 1 over its total length, wherein the amino acid sequence comprises

(i) at the positions corresponding to positions 3, 4, 99 and 199 the amino acid substitutions S3T, V4I, R99E and V199I; and

(ii) at at least one of the positions corresponding to positions 74, 136, 143, 154, 160, 161, 163, 171, 181, 183, 185, 200, 203, 209, 212 or 256 at least one further amino acid substitution, in particular selected from N74D/E/Q, A136Q, R143L/W/Y, S154D/Q, S160G, Y161T, A163G, V171L, A181D, F183R, Q185R, Q200A/L/S/T, Y203K/V/W, A209K/W, N212S/T and L256D/E/Q, preferably selected from S154D, S160G, A181D, F183R, Q185R, Q200L, Y203W, A209K and L256E, in particular at least two, at least three, at least four or at least five further amino acid substitutions selected from N74D/E/Q, A136Q, R143L/W/Y, S154D/Q, S160G, Y161T, A163G, V171L, A181D, F183R, Q185R, Q200A/L/S/T, Y203K/V/W, A209K/W, N212S/T and L256D/E/Q, preferably selected from S154D, S160G, A181D, F183R, Q185R, Q200L, Y203W, A209K and L256E,

based on the numbering of SEQ ID NO:1 over its total length.

[0036] In preferred embodiments, the detergent composition according to the invention comprises at least one protease with one of the following amino acid substitution variants:

(i) S3T-V4I-R99E-V199I-Q200L-Y203W;
(ii) S3T-V4I-R99E-V199I-N212S;
(iii) S3T-V4I-R99E-V199I-N74D;
(iv) S3T-V4I-R99E-V199I-S154D-L256E;
(v) S3T-V4I-R99E-V199I-Q200L-Y203W-S154D-L256E;
(vi) S3T-V4I-R99E-V199I-N74D-Q200L-Y203W;
(vii) S3T-V4I-R99E-V199I-N74D-S154D-Q200L-Y203W-L256E;
(viii) S3T-V4I-R99E-V199I-N74D-N212S;
(ix) S3T-V4I-R99E-V199I-N74D-S154D-Y203W-L256E;
(x) S3T-V4I-R99E-V199I-N74D-Y203W;
(xi) S3T-V4I-R99E-V199I-N74D-S154D-Q200L-L256E;
(xii) S3T-V4I-R99E-V199I-N74D-Q200L;
(xiii) S3T-V4I-R99E-V199I-S154D-Q200L-Y203W;
(xiv) S3T-V4I-R99E-V199I-Q200L-Y203W-L256E;
(xv) S3T-V4I-R99E-V199I-A136Q-R143W-Y161T-Q200L;
(xvi) S3T-V4I-R99E-V199I-N74D-R143Y-A209W-N212S-L256E;
(xvii) S3T-V4I-R99E-V199I-A136Q-S154D-V171L-Q200L;
(xviii) S3T-V4I-R99E-V199I-Q200L-Y203W-A209K-S154D-L256E;
(xix) S3T-V4I-R99E-V199I-S154D-S160G-Q185R-Q200L-Y203W-L256E;
(xx) S3T-V4I-R99E-V199I-S154D-A181D-F183R-Q200L-Y203W-L256E,

wherein the numbering is based on the numbering of SEQ ID NO:1.

[0037] In the context of the present invention, the feature whereby a protease has the given substitutions means that it contains one (of the given) substitution(s) at the relevant position, i.e. at least the given positions are not otherwise mutated or deleted, for example by fragmenting of the protease. In various preferred embodiments, the proteases described herein, with the exception of the explicitly mentioned substitutions, have the sequence of SEQ ID NO:1, i.e., are 100% identical to the sequence according to SEQ ID NO:1 except for the substituted positions.

[0038] The identity of nucleic acid or amino acid sequences is determined by a sequence comparison. This sequence comparison is based on the commonly used BLAST algorithm established in the prior art (see, for example, Altschul, S.F., Gish, W., Miller, W., Myers, E.W. & Lipman, D.J. (1990) "Basic local alignment search tool." J. Mol. Biol. 215: 403-410, and Altschul, Stephan F., Thomas L. Madden, Alejandro A. Schaffer, Jinghui Zhang, Hheng Zhang, Webb Miller, and David J. Lipman (1997): "Gapped BLAST and PSI-BLAST: a new generation of protein database search programs"; Nucleic Acids Res., 25, pp. 3389-3402) and occurs in principle by similar sequences of nucleotides or amino acids in the nucleic acid or amino acid sequences being assigned to one another. The assignment of the relevant positions shown in a table is referred to as an alignment. Another algorithm available in the prior art is the FASTA algorithm. Sequence comparisons (alignments), in particular multiple sequence comparisons, are created using computer programs. The Clustal series (cf., for example, Chenna et al. (2003): Multiple sequence alignment with the Clustal series of programs. Nucleic Acid Research 31, 3497-3500), T-Coffee (cf. for example Notredame et al. (2000): T-Coffee: A novel method for multiple sequence alignments. J. Mol. Biol. 302, 205-217) or programs based on these programs or algorithms are often used. Also possible are sequence comparisons (alignments) using the computer program Vector NTI® Suite 10.3 (Invitrogen Corporation, 1600 Faraday Avenue, Carlsbad, California, USA) with the specified standard

parameters, the AlignX-Modul of which program for the sequence comparisons is based on ClustalW. Unless stated otherwise, the sequence identity given herein is determined by the BLAST algorithm.

[0039] Such a comparison also allows a statement regarding the similarity of the compared sequences. It is usually given in percent identity, i.e. the proportion of identical nucleotides or amino acid residues in said sequences or in an alignment of corresponding positions. The broader concept of homology takes conserved amino acid exchanges into account in the case of amino acid sequences, i.e. amino acids having similar chemical activity, since they usually perform similar chemical activities within the protein. Therefore, the similarity between the compared sequences can also be expressed in percent homology or percent similarity. Identity and/or homology information can be provided regarding whole polypeptides or genes or only regarding individual regions. Homologous or identical regions of different nucleic acid or amino acid sequences are therefore defined by matches in the sequences. Such regions often have identical functions. They can be small and comprise only a few nucleotides or amino acids. Often, such small regions perform essential functions for the overall activity of the protein. It may therefore be expedient to relate sequence matches only to individual, optionally small regions. Unless stated otherwise, however, identity or homology information in the present application relates to the entire length of the particular nucleic acid or amino acid sequence indicated.

[0040] In the context of the present invention, the indication that an amino acid position corresponds to a numerically designated position in SEQ ID NO:1 therefore means that the corresponding position is associated with the numerically designated position in SEQ ID NO:1 in an alignment as defined above.

[0041] For the description of substitutions relating to exactly one amino acid position (amino acid exchanges), the following convention is used herein: first, the naturally occurring amino acid is designated in the form of the internationally used one-letter code, followed by the associated sequence position and finally the inserted amino acid. Several exchanges within the same polypeptide chain are separated by slashes. For insertions, additional amino acids are named following the sequence position. In the case of deletions, the missing amino acid is replaced by a symbol, for example a star or a dash, or a Δ is indicated before the corresponding position. For example, S3T describes the substitution of serine at position 3 by threonine, S3TH describes the insertion of histidine following the amino acid threonine at position 3 and S3* or ΔS3 describes the deletion of serine at position 3. This nomenclature is known to a person skilled in the field of enzyme technology.

[0042] According to the invention, the detergent composition comprises at least one amylase.

[0043] Examples of the amylases are α-amylases from *Bacillus licheniformis*, *Bacillus amyloliquefaciens* or *Bacillus stearothermophilus* and, in particular, their further developments improved for use in detergents or cleaning agents. The enzyme from *Bacillus licheniformis* is available from Novozymes under the trade name Termamyl® and from Danisco/DuPont under the name Purastar® ST. Further development products of this α-amylase are available under the trade names Duramyl® and Termamyl® ultra (both from Novozymes), Purastar® OxAm (Danisco/DuPont) and Keistase® (Daiwa Seiko Inc.). The α-amylase from *Bacillus amyloliquefaciens* is marketed by the company Novozymes under the name BAN® and derived variants of this α-amylase from *Bacillus stearothermophilus* under the trade name BSG® and Novamyl® (Novozymes). Furthermore, the α-amylase from *Bacillus sp.* A 7-7 (DSM 12368) and the cyclodextrin-glucanotransferase (CGTase) from *Bacillus agaradherens* (DSM 9948) are to be emphasized. Furthermore, the amylolytic enzymes can be used, which are disclosed in WO 95/26397, WO 96/23873, WO 99/23211, WO 00/60060, WO 2003/002711, WO 2003/054177, WO 2006/002643, WO 2007/079938, WO 2011/100410 and WO 2013/003659. Likewise, fusion products of all the molecules mentioned can be used. Additionally, the further developments of α-amylases from *Aspergillus niger* and *A. oryzae* are suitable, which are available under the trade name Fungamyl® from Novozymes. Further suitable products are, for example, Amylase-LT® and Stainzyme® or Stainzyme® ultra and Stainzyme® plus as well as Amplify™ 12L or Amplify Prime™ 100L, the latter also from the company Novozymes, and the PREFERENZ S® series from Danisco/DuPont, comprising, e.g., PREFERENZ S100®, PREFERENZ S1000® or PREFERENZ S210®. Variants of these enzymes obtainable by point mutations can also be used according to the invention.

[0044] In various embodiments, the at least one amylase is an amylase having amylolytic activity and selected from

a) an α-amylase comprising an amino acid sequence having at least 80%, preferably at least 81%, 82%, 83%, 84%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98% or 99% sequence identity to the amino acid sequence set forth in SEQ ID NO: 2 over the total length, and optionally comprising at least one amino acid substitution at at least one of the positions corresponding to positions 172, 202, 208, 255 and 261 of SEQ ID NO: 2, preferably selected from M202L, M202V, M202S, M202T, M202I, M202Q, M202W, S255N, R172Q and combinations thereof; and/or

b) an α-amylase comprising an amino acid sequence having at least 60%, preferably at least 61%, 62%, 63%, 64%, 65%, 66%, 67%, 68%, 69%, 79%, 71%, 72%, 73%, 74%, 75%, 76%, 77%, 78%, 79%, 80%, 81%, 82%, 83%, 84%, 85%, 86%, 87%, 88%, 89%, 90%, 90,5%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98% or 99% sequence identity to the amino acid sequence set forth in SEQ ID NO:3 over the total length, and optionally comprising at least one amino acid substitution at at least one position corresponding to positions 9, 26, 30, 33, 82, 37, 106, 118, 128, 133, 149, 150, 160, 178, 182, 186, 193, 195, 202, 203, 214, 231, 256, 257, 258, 269, 270, 272, 283, 295, 296, 298, 299,

303, 304, 305, 311, 314, 315, 318, 319, 320, 323, 339, 345, 361, 378, 383, 419, 421, 437, 441, 444, 445, 446, 447, 450, 458, 461, 471, 482 and 484 of SEQ ID NO:3 and/or a deletion at at least one of the positions 183 and 184 of SEQ ID NO:3, preferably at least one amino acid substitution at at least one of the positions 9, 26, 149, 182, 186, 202, 257, 295, 299, 323, 339 and 345, and/or more preferably at least one amino acid substitution or amino acid deletion selected from R118K, D183*, G184*, N195F, R320K, R458K and combinations thereof; and/or

c) an α-amylase comprising an amino acid sequence having at least 65%, preferably at least 66%, 67%, 68%, 69%, 79%, 71%, 72%, 73%, 74%, 75%, 76%, 77%, 78%, 79%, 80%, 81%, 82%, 83%, 84%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98% or 99% sequence identity to the amino acid sequence set forth in SEQ ID NO: 4 over the total length, and optionally having at least one substitution and/or deletion at at least one of the positions corresponding to positions 93, 116, 118, 129, 133, 134, 140, 142, 146, 147, 149, 151, 152, 169, 174, 183, 184, 186, 189, 193, 195, 197, 198, 200, 203, 206, 210, 212, 213, 235, 243, 244, 260, 262, 284, 303, 304, 320, 338, 347, 359, 418, 431, 434, 439, 447, 458, 469, 476 and 477 of SEQ ID NO:4, preferably amino acid deletions at the positions corresponding to positions 183 and 184; and/or

d) an α-amylase comprising an amino acid sequence having at least 89%, preferably at least 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98% or 99% sequence identity to the amino acid sequence set forth in SEQ ID NO:5 over the total length and having at least one deletion at at least one of the positions corresponding to positions 180, 181, 182, 183 and 184 of SEQ ID NO:5, preferably deletions at at least two positions selected from positions 180+181, 181+182, 182+183 and 183+184 of SEQ ID NO:5, more preferably at positions 183+184 of SEQ ID NO:5, and/or at least one substitution at at least one of the positions corresponding to positions 405, 421, 422 and 428 of SEQ ID NO:5 selected from 1405L, A421H, A422P, A428T and combinations thereof.

[0045] In particular, the at least one amylase comprises an amino acid sequence having at least 89%, preferably at least 90%, 90.5%, 91%, 91.5%, 92%, 92.5%, 93%, 93.5%, 94%, 94.5%, 95%, 95.5%, 96%, 96.5%, 97%, 97.5%, 98%, 98.5% or 99% sequence identity to the amino acid sequence set forth in SEQ ID NO:5 over the total length and having at least one deletion at at least one of the positions corresponding to positions 180, 181, 182, 183 and 184 of SEQ ID NO:5, preferably deletions at at least two positions selected from positions 180+181, 181+182, 182+183 and 183+184 of SEQ ID NO:5, more preferably at positions 183+184 of SEQ ID NO:5, in particular the deletions H183*+G184*, and/or at least one substitution at at least one of the positions corresponding to positions 405, 421, 422 and 428 of SEQ ID NO:5 selected from 1405L, A421H, A422P, A428T and combinations thereof.

[0046] In a preferred embodiment, the α-amylase has the deletions H183*+G184* and additionally the substitutions 1405L, A421H, A422P, and A428T, based on the numbering of SEQ ID NO:5.

[0047] In preferred embodiments, the amount of amylase in the detergent composition is reduced to equal to or less than 0.0034 wt.-%, most preferably 0.001 to 0.0033 wt.-%, for example equal to or less than 0.003 wt.-% or equal to or less than 0.0028. In particular, the reduction of the protease and/or amylase concentration in the detergent composition is helpful to reduce (detrimental) interactions between these enzymes.

[0048] The term "cellulase" as used herein refers to an enzyme that catalyzes the hydrolysis of 1,4-β-D-glucoside bonds in cellulose (cellobiose), and/or lichenin and/or β-D-glucans. They are often also able to hydrolyze the 1,4-bonds in β-D-glucans, which have 1,3-bonds in addition to the 1,4-bonds. Cellulases are able to cleave cellulose to β-glucose. Consequently, cellulases act in particular on cellulose-containing or cellulose derivative-containing residues and catalyze their hydrolysis. In preferred embodiments of the invention, the cellulase is an endoglucanase (EC 3.2.1.4). Synonymous names may be used for cellulases, in particular endoglucanase, endo-1,4-β-glucanase, carboxymethylcellulase, endo-1,4-β-D-glucanase, β-1,4-glucanase, β-1,4-endoglucanhydrolase, celludextrinase or avicelase.

[0049] The determining factor as to whether an enzyme is a cellulase in the context of the invention is its ability to hydrolyze 1,4-β-D-glucoside bonds into cellulose.

[0050] The term "cellulase activity" is defined herein as an enzyme that catalyzes the hydrolysis of 1,4-β-D-glucoside bonds into β-1,4-glucan (cellulose). Cellulose activity is measured by a standard method, such as the following: Cellulases release glucose from CMC (carboxymethylcellulose). Samples are incubated under defined reaction conditions (100 mM sodium phosphate buffer pH 7.5, 40°C, 15 min) with a substrate (1.25% CMC). Reaction with p-hydroxybenzoic acid hydrazide (PAHBAH) in the presence of bismuth produces a yellow dye that can be determined photometrically at 410 nm. The prerequisite is an alkaline pH during the color reaction. The amount of sugar released corresponding to the coloration is a measure of enzyme activity (Lever, Anal. Biochem., 1972, 47 & 1977, 81).

[0051] Suitable cellulases include those of bacterial or fungal origin. Chemically modified or protein engineered mutants are included. Suitable cellulases are cellulases from the genera *Bacillus, Pseudomonas, Humicola, Fusarium, Thielavia, Acremonium,* such as fungal cellulases from *Humicola insolens, Myceliophthora thermophila* and *Fusarium oxysporum,* which are disclosed in US 4435307, US 5648263, US 5691178, US 5776757 and WO 89/09259, for example. Particularly suitable cellulases are the alkaline or neutral cellulases with color-maintaining properties. Examples of such cellulases are cellulases, which are described in EP 0495257, EP 0531372, WO 96/11262, WO 96/29397 and WO 98/08940, for example. Other examples are cellulase variants as described in WO 94/07998, EP 0531315, EP 3212777, EP 3502243,

EP 3653705, EP 3653706, US 5457046, US 5686593, US 5763254, WO 95/24471, WO 98/12307, WO 99/01544 and WO 2019/122520, for example.

[0052] Examples of cellulases with endo-1,4-glucanase-activity (EC 3.2.1.4) are described in WO 2002/099091, e.g., those with a sequence having at least 97% identity with the amino acid sequence of the positions 1 to 773 of SEQ ID NO:2 from WO 2002/099091. A further example can comprise a GH44-xyloglycanase, e.g., a xyloglucanase enzyme having a sequence of at least 60% identity to the positions 40 to 559 of SEQ ID NO:2 from WO 2001/062903.

[0053] Further examples for cellulases comprise the GH45-cellulases as described in WO 96/29397 and in particular variants thereof having substitutions, insertions and/or deletions at one or more positions corresponding to the following positions of SEQ ID NO:8 from WO 2002/099091: 2, 4, 7, 8, 10, 13, 15, 19, 20, 21, 25, 26, 29, 32, 33, 34, 35, 37, 40, 42, 42a, 43, 44, 48, 53, 54, 55, 58, 59, 63, 64, 65, 66, 67, 70, 72, 76, 79, 80, 82, 84, 86, 88, 90, 91, 93, 95, 95d, 95h, 95j, 97, 100, 101, 102, 103, 113, 114, 117, 119, 121, 133, 136, 137, 138, 139, 140a, 141, 143a, 145, 146, 147, 150e, 150j, 151, 152, 153, 154, 155, 156, 157, 158, 159, 160c, 160e, 160k, 161, 162, 164, 165, 168, 170, 171, 172, 173, 175, 176, 178, 181, 183, 184, 185, 186, 188, 191, 192, 195, 196, 200, and/or 20, preferably selected from P19A, G20K, Q44K, N48E, Q119H or Q146R.

[0054] Commercially available cellulases comprise Celluzyme™, Carezyme™, Carezyme Premium™, Celluclean™ (e.g. Celluclean™ 5000L and Celluclean™ 4000T), Celluclean Classic™, Cellusoft™, Endolase®, Renozyme® and Whitezyme™ (Novozymes A/S), Clazinase™ and Puradax HA™ (Genencor International Inc.), KAC-500(B)™ (Kao Corporation), Revitalenz™ 1000, Revitalenz™ 2000 and Revitalenz™ 3000 (DuPont), as well as Ecostone® and Biotouch® (AB Enzymes).

[0055] In various embodiments, the present detergent composition according to the invention can comprise at least one lipase.

[0056] Lipases are among the most technically important enzymes of all. Their use for detergents and cleaning agents is industrially established and they are present in virtually all modern, high-performance detergents and cleaning agents. A lipase is an enzyme that catalyzes the hydrolysis of ester bonds in lipid substrates, especially fats and oils. Lipases therefore represent a group of esterases. Lipases are generally versatile enzymes that accept a wide variety of substrates, for example, aliphatic, alicyclic, bicyclic and aromatic esters, thioesters and activated amines. Lipases act against fatty residues in laundry and catalyze their hydrolysis (lipolysis). Lipases with broad substrate spectra are used in particular where inhomogeneous raw materials or substrate mixtures have to be reacted, i.e., for example, in detergents and cleaning agents, since soils can consist of fats and oils with different compositions. The lipases used in detergents or cleaning agents known from the prior art are usually of microbial origin and are usually derived from bacteria or fungi, for example of the genera Thermomyces, Bacillus, Pseudomonas, Acinetobacter, Micrococcus, Humicola, Trichoderma or Trichosporon. Lipases are usually produced by suitable microorganisms using biotechnological methods known per se, for example by transgenic expression hosts of the genera Bacillus or by filamentous fungi.

[0057] Examples include lipases from Thermomyces, e.g., from *T. lanuginosus* (formerly called *Humicola lanuginosa*), as described in EP 0258068 and EP 0305216 , lipases from strains of *Pseudomonas* (some of these now renamed to *Burkholderia*), e.g., *P. alcaligenes* or *P. pseudoalcaligenes* (EP 0218272), *P. cepacia* (EP 0331376), *P. sp.* strain SD705 (WO 95/06720 and WO 96/27002), *P. wisconsinensis* (WO 96/12012), GDSL-type *Streptomyces-lipases* (WO 2010/065455), lipases from *Thermobifida fusca* (WO 2011/084412), lipases from *Geobacillus stearothermophilus* (WO 2011/084417), lipases from *Bacillus subtilis* (WO 2011/084599), and lipases from *Streptomyces griseus* (WO 2011/150157) and S. *pristinaespiralis* (WO 2012/137147).

[0058] Preferred lipases include, for example, those lipases originally obtainable from *Humicola lanuginosa* (*Thermomyces lanuginosus*) or those further developed from it, in particular those with one or more of the following amino acid substitutions in the positions D96L, T213R and/or N233R, particularly preferably T213R and N233R, starting from the said lipase. Lipases are commercially available, e.g., from the company Novozymes under the trade names Lipolase®, Lipolase® Ultra, LipoPrime®, Lipozyme® and Lipex®. Another advantageously applicable lipase is available under the trade name Lipoclean® from Novozymes.

[0059] Furthermore, useful lipases are, e.g., available from Amano under the names Lipase CE®, Lipase P®, Lipase B® or Lipase CES®, Lipase AKG®, Bacillus sp. Lipase®, Lipase AP®, Lipase M-AP® and Lipase AML®. Other important commercial products include the preparations M1 Lipase® and Lipomax® marketed by Danisco/DuPont and the enzymes marketed by Meito Sangyo KK under the names Lipase MY-30®, Lipase OF® and Lipase PL®, as well as the product Lumafast® from Danisco/DuPont.

[0060] Further examples are lipases sometimes referred to as acyltransferases or perhydrolases, e.g., acyltransferases with homology to *Candida antarctica* lipase A (WO 2010/111143), acyltransferase from *Mycobacterium smegmatis* (WO 2005/056782), perhydrolases from the CE 7 family (WO 2009/067279), and variants of the *M. smegmatis* perhydrolase, in particular the S54V variant used in the commercial product Gentle Power Bleach from Huntsman Textile Effects Pte Ltd (WO 2010/100028). Other examples are lipase variants such as those described in EP 0407225, WO 92/05249, WO 94/01541, WO 94/25578, WO 95/14783, WO 95/30744, WO 95/35381, WO 95/22615, WO 96/00292, WO 97/04079, WO 97/07202, WO 2000/034450, WO 2000/060063, WO 2001/092502, WO 2007/087508 and WO 2009/109500.

[0061] Preferred commercial lipase products include Lipolase™, Lipex™, Lipolex™ and Lipoclean™ (Novozymes A/S), Lumafast (Genencor / DuPont) and Lipomax (Gist-Brocades).

[0062] In various embodiments, a suitable lipase comprises an amino acid sequence having at least 70% sequence identity to the amino acid sequence set forth in SEQ ID NO: 6 over the total length thereof and having at least one amino acid substitution at position 83, 86, 87, 89, 90, 92, 93, 95, 113, 174, 202, 203, 205, 206, 207, 208, 209, 211, 227, 252, 253, 256, 258, 259, 260, 264, or 267, each based on the numbering according to SEQ ID NO: 6, preferably such that the lipase comprises at least one of the amino acid substitutions P208N, F211N, P253N, based on the numbering according to SEQ ID NO:6.

[0063] In various embodiments, the lipase according to the invention further comprises the amino acid substitutions T231R and N233R, each based on the numbering according to SEQ ID NO:6.

[0064] Such lipases, which are preferred according to the invention, are indicated in SEQ ID Nos:6-10.

[0065] In preferred embodiments, the amount of lipase in the detergent composition is increased to equal to or more than 0.003 wt.-% or equal to or more than 0.0033 wt.-% or equal to or more than 0.004 wt.-%, for example 0.0033 to 0.008 wt.-%, based on the active protein content and the total weight of the detergent composition. In particular, the lipase concentration is increased to improve the primary washing performance of the detergent composition.

[0066] Further enzymes that can be comprised in the detergent composition according to the invention is any enzyme which can develop a catalytic activity in the detergent composition according to the invention, in particular, without being limited to that, a hemicellulase, mannanase, tannase, xylanase, xanthanase, xyloglucanase, β-glucosidase, pectinase, carrageenase, perhydrolase, oxidase, oxidoreductase as well as mixtures thereof. Advantageously, further enzymes can be contained in the detergent composition in an amount of 1×10^{-8} to 5 percent by weight, preferably 0.0001 to 1 percent by weight, based on active protein, in each case. However, it is preferred that the detergent composition is essentially free of or free of any further enzyme, in particular the detergent composition is essentially free of or free of a mannanase. Preferably, the reduction or removal of mannanase in the detergent composition results in decreased (detrimental) interactions between the mannanase and the protease.

[0067] In preferred embodiments, the detergent composition according to the invention comprises at least one protease, at least one amylase, at least one cellulase and at least one lipase, in the amounts and ratios as defined herein. Preferably, in such a detergent composition, the enzymes are comprised in a total amount of from 0.0012 to 5 wt.-%, preferably 0.005 to 1 wt.-%, more preferably 0.008 to 0.8 wt.-%, most preferably 0.01 to 0.8 wt.-%, for example 0.01 to 0.5 or 0.01 to 0.25 wt.-%, based on the active protein content and the total weight of the detergent composition.

[0068] Protein concentration can be determined by known methods, for example, the BCA (bicinchoninic acid; 2,2'-biquinolyl-4,4'-dicarboxylic acid) method or the Biuret method (Gornall et al., 1948, J. Biol. Chem., 177:751-766). In this regard, determination of the active protein content can be accomplished by titration of the active sites using a suitable irreversible inhibitor and determination of the residual activity (Bender et al., 1966, J. Am. Chem. Soc. 88, 24:5890-5913).

[0069] In the detergent compositions described herein, the enzymes to be used may further be formulated together with accompanying substances, such as those derived from fermentation. In liquid formulations, the enzymes are preferably used as enzyme liquid formulation(s).

[0070] The enzymes are generally not provided in the form of the pure protein, but rather in the form of stabilized preparations that can be stored and transported. These prepackaged preparations include, for example, the solid preparations obtained by granulation, extrusion or lyophilization or, particularly in the case of liquid or gel form, solutions of the enzymes, advantageously as concentrated as possible, with as little water as possible and/or with stabilizers or other auxiliaries added.

[0071] Alternatively, the enzymes can be encapsulated for both the solid and liquid dosage forms, for example by spray drying or extrusion of the enzyme solution together with a preferably natural polymer or in the form of capsules, for example those in which the enzymes are enclosed as in a solidified gel or in those of the core-shell type, in which an enzyme-containing core is coated with a water-, air- and/or chemical-impermeable protective layer. Additional active ingredients, for example stabilizers, emulsifiers, pigments, bleaching agents or dyes, can be applied in superimposed layers. Such capsules are applied by methods known per se, for example by shaking or rolling granulation or in fluid-bed processes. Advantageously, such granules, for example by applying polymeric film formers, are low in dust and stable in storage due to the coating.

[0072] Furthermore, it is possible to package two or more enzymes together so that a single granule has multiple enzyme activities.

[0073] The enzymes can also be incorporated into water-soluble films, such as those used in the packaging of detergents and cleaning agents in unit dose form. Such a film allows the enzymes to be released upon contact with water. As used herein, "water soluble" refers to a film structure that is preferably completely water soluble. Preferably, such a film consists of (fully or partially hydrolyzed) polyvinyl alcohol (PVA).

[0074] In various embodiments, the detergent composition according to the invention may comprise one or more surfactants, for example anionic, non-ionic, zwitterionic, amphoteric and/or cationic surfactants, anionic and non-ionic surfactants being significantly preferred for economic reasons and due to the performance spectrum thereof during

washing.

[0075] Anionic surfactants that are used are those of the sulfonate and sulfate types, for example. Surfactants of the sulfonate type that can be used are preferably C_{9-13} alkylbenzene sulfonates, olefin sulfonates, i.e. mixtures of alkene and hydroxyalkane sulfonates, and disulfonates, as obtained, for example, from C_{12-18} monoolefins having a terminal or internal double bond by way of sulfonation with gaseous sulfur trioxide and subsequent alkaline or acid hydrolysis of the sulfonation products. Alkane sulfonates obtained from C_{12-18} alkanes, for example by way of sulfochlorination or sulfoxidation with subsequent hydrolysis or neutralization, are also suitable. Likewise, the esters of α-sulfofatty acids (ester sulfonates) are suitable, for example the α-sulfonated methyl esters of hydrogenated coconut fatty acids, palm kernel fatty acids or tallow fatty acids.

[0076] Sulfated fatty acid glycerol esters are further suitable anionic surfactants. Fatty acid glycerol esters shall be understood to mean the monoesters, diesters and triesters and mixtures thereof, as they are obtained during preparation by way of the esterification of a monoglycerol with 1 to 3 moles fatty acid or during the transesterification of triglycerides with 0.3 to 2 moles glycerol. Preferred sulfated fatty acid glycerol esters are the sulfation products of saturated fatty acids having 6 to 22 carbon atoms, for example of caproic acid, caprylic acid, capric acid, myristic acid, lauric acid, palmitic acid, stearic acid or behenic acid.

[0077] The alkali salts and in particular the sodium salts of the sulfuric acid half-esters of C_{12}-C_{18} fatty alcohols, for example from coconut fatty alcohol, tallow fatty alcohol, lauryl alcohol, myristyl alcohol, cetyl alcohol or stearyl alcohol, or of C_{10}-C_{20} oxo alcohols and the half-esters of secondary alcohols having these chain lengths are preferred as alk(en)yl sulfates. Alk(en)yl sulfates of the mentioned chain length that contain a synthetic straight-chain alkyl group prepared on a petrochemical basis and have a degradation behavior similar to that of the adequate compounds based on fat chemical raw materials are also preferred. From a washing perspective, the C_{12}-C_{16} alkyl sulfates, C_{12}-C_{15} alkyl sulfates and C_{14}-C_{15} alkyl sulfates are preferred.

[0078] The sulfuric acid monoesters of straight-chain or branched C_{7-21} alcohols ethoxylated with 1 to 6 mol of ethylene oxide, such as 2-methyl-branched C_{9-11} alcohols having, on average, 3.5 mol ethylene oxide (EO) or C_{12-18} fatty alcohols having 1 to 4 EO, are also suitable.

[0079] Further suitable anionic surfactants are also the salts of alkyl sulfosuccinic acid, which are also referred to as sulfosuccinates or as sulfosuccinic acid esters and represent monoesters and/or diesters of sulfosuccinic acid with alcohols, preferably fatty alcohols, and in particular ethoxylated fatty alcohols. Preferred sulfosuccinates contain C_{8-18} fatty alcohol groups or mixtures of these. In particular, preferred sulfosuccinates contain a fatty alcohol group that is derived from ethoxylated fatty alcohols, which taken alone represent non-ionic surfactants (for description see below). Among these, in turn, sulfosuccinates including fatty alcohol groups that derive from ethoxylated fatty alcohols exhibiting a restricted distribution of homologs are particularly preferred. Likewise, it is also possible to use alk(en)yl succinic acid having preferably 8 to 18 carbon atoms in the alk(en)yl chain, or the salts thereof.

[0080] Further anionic surfactants that can also be used are in particular soaps. Saturated fatty acid soaps are suitable, such as the salts of lauric acid, myristic acid, palmitic acid, stearic acid, hydrogenated erucic acid and behenic acid, and in particular soap mixtures derived from natural fatty acids, such as coconut fatty acids, palm kernel fatty acids or tallow fatty acids.

[0081] The anionic surfactants, including the soaps, can be present in the form of the sodium, potassium or ammonium salts thereof, or as soluble salts of organic bases, such as monoethanolamine, diethanolamine or triethanolamine. The anionic surfactants are preferably present in the form of the sodium, potassium or magnesium salts thereof, and in particular in the form of the sodium salts.

[0082] There are no general conditions that must be adhered to that would stand in the way of having a degree of freedom in terms of formulation when selecting the anionic surfactants. The use of alkylbenzene sulfonates and fatty alcohol sulfates as anionic surfactants is preferred.

[0083] Non-ionic surfactants that are preferably used are alkoxylated, advantageously ethoxylated, in particular primary alcohols having preferably 8 to 18 C atoms and, on average, 1 to 12 mols of ethylene oxide (EO) per mol of alcohol, in which the alcohol group can be linear or preferably methyl-branched in the 2 position, or can contain linear and methyl-branched groups in admixture, as are usually present in oxo alcohol groups. However, alcohol ethoxylates having linear groups of alcohols of native origin having 12 to 18 C atoms, for example of coconut, palm, tallow fatty or oleyl alcohol, and an average of 2 to 8 EO per mol of alcohol, are particularly preferred. Examples of preferred ethoxylated alcohols include C_{12-14} alcohols having 3 EO or 4 EO, C_{9-11} alcohol having 7 EO, C_{13-15} alcohols having 3 EO, 5 EO, 7 EO or 8 EO, C_{12-18} alcohols having 3 EO, 5 EO or 7 EO, and mixtures thereof, such as mixtures of C_{12-14} alcohol having 3 EO and C_{12-18} alcohol having 5 EO. The degrees of ethoxylation indicated represent statistical averages that can correspond to an integer or a fractional number for a specific product. Preferred alcohol ethoxylates have a narrowed homolog distribution (narrow range ethoxylates, NRE). In addition to these non-ionic surfactants, fatty alcohols having more than 12 EO can also be used. Examples of these are tallow fatty alcohols having 14 EO, 25 EO, 30 EO, or 40 EO.

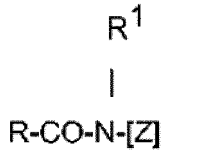
[0084] Another class of preferably used non-ionic surfactants, which are used either as the only non-ionic surfactant or in combination with other non-ionic surfactants, are alkoxylated, preferably ethoxylated or ethoxylated and propoxylated

fatty acid alkyl esters, preferably having 1 to 4 carbon atoms in the alkyl chain, in particular fatty acid methyl esters.

[0085] Another class of non-ionic surfactants that can advantageously be used is the alkyl polyglycosides (APG). Alkyl polyglycosides that can be used satisfy the general formula RO(G)z, in which R represents a linear or branched, in particular methyl-branched at the 2-position, saturated or unsaturated aliphatic group having 8 to 22, preferably 12 to 18, C atoms, and G is the symbol that represents a glycose unit having 5 or 6 C atoms, preferably glucose. The degree of glycosidation z is between 1.0 and 4.0, preferably between 1.0 and 2.0, and in particular between 1.1 and 1.4. Linear alkyl polyglycosides are preferably used, which is to say alkyl polyglycosides in which the polyglycol group is a glucose group and the alkyl group is an n-alkyl group.

[0086] Non-ionic surfactants of the amine oxide type, for example N-cocoalkyl-N,N-dimethylamine oxide and N-tallow alkyl-N,N-dihydroxyethylamine oxide, and of the fatty acid alkanolamides may also be suitable. The quantity of these non-ionic surfactants is preferably no more than that of the ethoxylated fatty alcohols, in particular no more than half thereof.

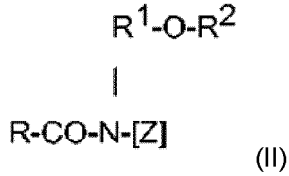
[0087] Further suitable surfactants are polyhydroxy fatty acid amides of formula (I),



(I)

in which RCO denotes an aliphatic acyl group having 6 to 22 carbon atoms, R^1 denotes hydrogen, an alkyl or hydroxyalkyl group having 1 to 4 carbon atoms, and [Z] denotes a linear or branched polyhydroxyalkyl group having 3 to 10 carbon atoms and 3 to 10 hydroxyl groups. The polyhydroxy fatty acid amides are known substances that can usually be obtained by the reductive amination of a reducing sugar with ammonia, an alkylamine or an alkanolamine, and subsequent acylation with a fatty acid, a fatty acid alkyl ester or a fatty acid chloride.

[0088] The group of polyhydroxy fatty acid amides also includes compounds of formula (II),



(II)

in which R denotes a linear or branched alkyl or alkenyl group having 7 to 12 carbon atoms, R^1 denotes a linear, branched or cyclic alkyl group or an aryl group having 2 to 8 carbon atoms, and R^2 denotes a linear, branched or cyclic alkyl group or an aryl group or an oxy alkyl group having 1 to 8 carbon atoms, C_{1-4} alkyl or phenyl groups being preferred, and [Z] denotes a linear polyhydroxyalkyl group, the alkyl chain of which is substituted with at least two hydroxyl groups, or alkoxylated, preferably ethoxylated or propoxylated derivatives of this group. [Z] is preferably obtained by the reductive amination of a reduced sugar, for example glucose, fructose, maltose, lactose, galactose, mannose or xylose. The N-alkoxy- or N-aryloxy-substituted compounds can then be converted, by reaction with fatty acid methyl esters in the presence of an alkoxide as the catalyst, to the desired polyhydroxy fatty acid amides, for example according to the teaching of the international application WO-A-95/07331.

[0089] In various embodiments, the detergent composition is free of cationic surfactants.

[0090] The detergent compositions according to the invention may comprise at least one surfactant in an amount of preferably 1 to 70 wt.-%, more preferably 1 to 60 wt.-% and in particular 1 to 50 wt.-%, based on the total weight of the detergent composition.

[0091] In various embodiments, the detergent composition according to the invention, preferably the liquid laundry detergent composition, comprises at least one surfactant, preferably at least one anionic and/or nonionic surfactant, more preferably in an amount of from 1 to 50 wt.-%, preferably 2 to 35 wt.-%, more preferably 5 to 35 wt.-%, most preferably 10 to 30 wt.-%, for example 12 to 30 wt.-% or 15 to 28 wt.-%, based on the total weight of the detergent composition.

[0092] In various embodiments, the detergent composition according to the invention further comprises at least one acid, preferably citric acid and/or boric acid or salt thereof. Suitable salts of these acids are known in the art and comprise alkali metal salts as well as salts with ammonium or organic cations. While in the following reference is made to acids, it is understood that the respective embodiments also comprise the respective salts of these acids.

[0093] Preferably, the at least one acid, preferably at least two acids, is/are comprised in the composition in an amount

of from 0.01 to 15 wt.-%, preferably 0.1 to 10 wt.-%, more preferably 0.5 to 4 wt.-%, more preferably 0.9 to 3 wt.-%, most preferably in an amount of less than 2.3 wt.-%, for example less than 2.2 wt.-% such as 2.0 wt.-%, 2.1 wt.-% or 2.09 wt.-%, based on the total weight of the detergent composition.

[0094] In various embodiments, the at least one acid is boric acid, wherein boric acid is comprised in the detergent composition in an amount of from 0.01 to 15wt.-%, preferably 0.1 to 10 wt.-%, more preferably 0.1 to 5 wt.-%, more preferably 0.1 to 3 wt.-%, more preferably 0.1 to 2 wt.-%, more preferably in an amount of less than 1 wt.-%, more preferably less than 0.9 wt.-%, more preferably less than 0.88 wt.-%, more preferably less than 0.85 wt.-%, most preferably less than 0.8 wt.-% such as 0.79 wt.-%, 0.75 wt.- %, 0.70 wt.-% or 0.5 wt.-%, based on the total weight of the detergent composition. It is preferred that the reduction of acids, in particular boric acid, in the detergent composition according to the invention to less than 2.5 wt.-%, preferably to less than 2.1 wt.-%, more preferably to less than 1 wt.-%, more preferably to less than 0.9 wt.-%, more preferably to less than 0.88 wt.-%, more preferably to less than 0.85 wt.-%, most preferably to less than 0.8 wt.-% such as 0.79 wt.-%, preferably results in reduced interactions with the at least one protease of the composition.

[0095] The detergent composition can also comprise boric acid and citric acid together.

[0096] Preferably, citric acid is comprised in the detergent composition in amounts of from 0.01 to 15 wt.-%, preferably 0.1 to 10 wt.-%, more preferably 0.5 to 6 wt.-%, most preferably 0.8 to 1.8 wt.-% such as 1 wt.-%, 1.3 wt.-% or 1.5 wt.-%. In various embodiments, citric acid is comprised in amounts of less than 2 wt.-%, preferably less than 1.8 wt.-%, more preferably less than 1.5 wt.-% such as 1.3 wt.-%, based on the total weight of the detergent composition.

[0097] In various embodiments, the detergent composition can be free of boric acid. It is also possible, in various embodiments, that the detergent composition is essentially free or completely free of boron-containing compounds.

[0098] If the detergent composition is a liquid laundry detergent composition, it can comprise more than 40 wt.- % water, preferably 50 to 90 wt.-% and particularly preferably 60 to 80 wt.-% water.

[0099] The detergent composition according to the invention can also comprise any further constituent that is typical for detergent compositions, in particular for liquid laundry detergent compositions.

[0100] Suitable further constituents or additives, without being limited to that, are selected from the group of bleaching agents, complexing agents, builders, preservatives, electrolytes, thickeners, non-aqueous solvents, pH adjusters, alkalis, fragrances, fragrance carriers, fluorescing agents, dyes, hydrotropic substances, suds control agents, silicone oils, anti-redeposition agents, further greying inhibitors, anti-shrink agents, anti-crease agents, dye transfer inhibitors, antimicrobial active ingredients, germicides, fungicides, antioxidants, rheology modifier, rheology stabilizer, corrosion inhibitors, anti-static agents, bittering agents, ironing aids, repellents and impregnating agents, anti-swelling and anti-slip agents, softening components and UV absorbers, preferably from fragrances, dyes, alkalis, preservatives, fluorescing agents, suds control agents, rheology modifier, rheology stabilizer, non-aqueous solvents, builders and thickeners and mixtures thereof.

[0101] In various embodiments, the detergent composition may have a pH in the range of from approx. 6 to approx. 11, preferably approx. 6.5 to approx. 10.5, more preferably approx. 7 to approx. 10, in particular approx. 8 to approx. 9 such as 8.6, 8.4 or 8.2, e.g. in a 1 wt.-% solution with deionized water at 20 °C.

[0102] In preferred embodiments, the detergent composition has a viscosity at 20 °C of 500 to 100,000 mPa·s, preferably 1000 to 2000 mPa·s, more preferably 1100 to 1900 mPa·s such as 1500 mPa·s, preferably measured with a Brookfield viscometer (spindle 3, speed 20).

[0103] A further aspect according to the invention is an agent or article, preferably a detergent, more preferably a liquid laundry detergent, comprising or (essentially) consisting of the detergent composition, preferably the liquid laundry detergent composition, as described herein.

[0104] In various embodiments, the detergent composition according to the invention, preferably the liquid laundry detergent composition, is an agent or article in unit dose, e.g. pouches, preferably with a water-soluble film.

[0105] In a further aspect, the invention relates to a method for preventing or removing greying of a fabric, comprising contacting said fabric with a composition comprising at least one cellulase, at least one protease and at least one amylase and optionally at least one lipase, preferably with a detergent composition or an agent or article as described herein. Preferably, contacting said fabric with said composition, agent or article is carried out during a washing process.

[0106] The term "fabric" includes any type of textile, for example, garments, carpets, and textile furniture surfaces.

[0107] In various embodiments, the at least one protease is present in the composition used in the method in an amount of from 0.001 to 0.1 wt.-%, preferably 0.001 to 0.05 wt.-%, more preferably 0.001 to 0.03 wt.- %, more preferably 0.005 to 0.029 wt.-%, more preferably 0.01 to 0.026 wt.-%, for example equal to or less than 0.024 wt.-%, most preferably 0.01 to 0.023 wt.-%, for example equal to or less than 0.02 wt.- %; and/or the at least one amylase is present in the composition in an amount of from 0.0001 to 0.01 wt.-%, preferably 0.0001 to 0.005 wt.-%, more preferably 0.001 to 0.005 wt.-%, more preferably 0.001 to 0.004 wt.-%, for example equal to or less than 0.0034 wt.-%, most preferably 0.001 to 0.0033 wt.-%, for example equal to or less than 0.003 wt.-%; and/or the at least one cellulase is present in the composition in an amount of from 0.0001 to 0.01 wt.-%, preferably 0.0001 to 0.008 wt.-%, more preferably 0.0001 to 0.003 wt.-%, more preferably 0.0005 to 0.0025 wt.-%, for example 0.0006 to 0.002 wt.-% or 0.0006 to 0.0015 wt.-%;

and/or optionally at least one lipase is present in the composition in an amount of from 0.0001 to 0.1 wt.-%, preferably 0.0001 to 0.1 wt.-%, more preferably 0.0005 to 0.01 wt.-%, more preferably 0.001 to 0.01 wt.-%, for example equal to or more than 0.003 wt.-% or equal to or more than 0.0033 wt.-%, most preferably 0.0033 to 0.008 wt.-%;
each based on the active protein content and the total weight of the composition.

[0108] In preferred embodiments, the composition used in the method comprises

i) higher levels of protease than cellulase; and/or
ii) higher levels of protease than lipase; and/or
iii) higher levels of protease than amylase; and/or
iv) higher levels of amylase than cellulase; and/or
v) higher levels of lipase than amylase; and/or
vi) higher levels of lipase than cellulase; and/or
vii) higher levels of protease, amylase and/or lipase than cellulase; and/or
viii) higher levels of protease than amylase, cellulase and, optionally, lipase;

each based on the active protein content and the total weight of the detergent composition.

[0109] In various embodiments, the weight ratio of the amount of protease to cellulase is in the range of from 97:3 to 80:20; and/or the weight ratio of the amount of protease to amylase is in the range of from 95:5 to 75:25; and/or the weight ratio of the amount of amylase to cellulase is in the range of from 80:20 to 60:40; preferably

i) the weight ratio of the amount of protease to cellulase is in the range of from 96:4 to 85:15, preferably 95:5 to 88:12, more preferably 95:5 to 90:10, most preferably 95:5 to 92:8; and/or
ii) the weight ratio of the amount of amylase to cellulase is in the range of from 78:22 to 65:35, preferably 77:23 to 68:32, more preferably 76:24 to 70:30, most preferably 76:24 to 72:28; and/or
iii) the weight ratio of the amount of protease to amylase is in the range of from 90:10 to 80:20, preferably 88:12 to 81:19, most preferably 86:14 to 82:18; and/or
iv) the weight ratio of the amount of protease and amylase together to cellulase is in the range of from 99.9:0.1 to 70:30, preferably 99:1 to 75:25, more preferably 98:2 to 80:20, more preferably 98:2 to 85:1, more preferably 97:3 to 90:10, most preferably 96:4 to 91:9; and/or
v) the weight ratio of the amount of the at least one protease and cellulase together and the at least one amylase is in the range of from 99.9:0.1 to 60:40, preferably 99:1 to 70:30, more preferably 95:5 to 75:25, more preferably 90:10 to 78:22, most preferably 88:12 to 80:20; and/or
vi) the weight ratio of the amount of the at least one protease and the amount of the at least one amylase and cellulase together is in the range of from 99:1 to 60:40, preferably 95:5 to 65:35, more preferably 90:10 to 70:30, more preferably 87:13 to 73:27, most preferably 84:16 to 75:25; and/or
vii) optionally the weight ratio of the amount of the at least one lipase to the at least one cellulase is in the range of from 99.9:0.1 to 60:40, preferably 99:1 to 65:35, more preferably 95:5 to 70:30, more preferably 93:7 to 75:25 wt.-%, more preferably 90:10 to 78:22, more preferably 89:11 to 80:20, most preferably 89:11 to 82:18; and/or
viii) optionally the weight ratio of the amount of the at least one protease to the at least one lipase is in the range of from 99:1 to 50:50; preferably 95:5 to 55:45; more preferably 90:10 to 60:40, more preferably 85:15 to 60:40, more preferably 80:20 to 60:40, more preferably 77:23 to 65:35, most preferably 75:25 to 67:33; and/or
ix) optionally the weight ratio of the amount of the at least one lipase to the at least one amylase is in the range of from 99:1 to 50:50; preferably 95:5 to 55:45, more preferably 90:10 to 55:45, more preferably 85:15 to 55:45, more preferably 80:20 to 55:45, more preferably 75:25 to 60:40, most preferably 73:27 to 62:38; and/or
x) optionally the weight ratio of the amount of the at least one protease and lipase together to the at least one cellulase is in the range of from 99.99:0.01 to 70:30, preferably 99.9:0.1 to 75:25, more preferably 99.5:0.5 to 80:20, more preferably 99.1:0.9 to 85:15, most preferably 99:1 to 90:10; and/or
xi) optionally the weight ratio of the amount of the at least one lipase and amylase together to the at least one cellulase is in the range of from 99.99:0.01 to 70:30, preferably 99.9:0.1 to 75:25, more preferably 99.5:0.5 to 80:20, more preferably 99:1 to 82:18, most preferably 95:5 to 84:16; and/or
xii) optionally the weight ratio of the amount of the at least one protease and cellulase together and the at least one lipase is in the range of 99:1 to 50:50, preferably 95:5 to 60:40, more preferably 90:10 to 65:35, more preferably 85:15 to 65:35, more preferably 80:20 to 65:35, most preferably 78:22 to 69:31; and/or
xiii) optionally the weight ratio of the amount of the at least one lipase and the amount of the at least one amylase and cellulase together is in the range of 80:20 to 40:60, preferably 75:25 to 50:50, more preferably 70:30 to 52:48, most preferably 65:35 to 55:45; and/or
xiv) optionally the weight ratio of the amount of the at least one protease, amylase and lipase together to the at least one cellulase is in the range of from 99.99:0.01 to 80:20, preferably 99.9:0.1 to 85:15, more preferably 99:1 to 88:12,

more preferably 98:2 to 90:10, most preferably 97:3 to 92:8; and/or
xv) optionally the weight ratio of the amount of at least one protease to the at least one cellulase, amylase and lipase together is in the range of from 80:20 to 40:60, preferably 75:25 to 50:50, more preferably 70:30 to 50:50, more preferably 65:35 to 58:42, most preferably 63:35 to 58:42; and/or
xvi) optionally the weight ratio of the amount of the at least one protease, lipase and cellulase together to the at least one amylase is in a range of from 99.9:0.1 to 60:40, preferably 99:1 to 70:30, more preferably 98:2 to 75:25, more preferably 95:5 to 78:22, most preferably 93:7 to 82:18; and/or
xvii) optionally the weight ratio of the amount of the at least one protease, amylase and cellulase together to the at least one lipase is in a range of from 95:5 to 50:50, preferably 90:10 to 60:40, more preferably 85:15 to 65:35, more preferably 80:20 to 70:30, most preferably 80:20 to 73:27;

each based on the active protein content of the respective enzymes in the detergent composition.

[0110] Preferably, the composition used in the method according to the invention comprises at least one protease, at least one amylase, at least one lipase and at least one cellulase. Most preferred, the composition does not comprise any further enzyme, in particular the composition is essentially free of or free of a mannanase.

[0111] In preferred embodiments, the washing process is a machine-washing process or a hand-washing process, preferably a machine-washing process. In preferred embodiments, the washing process comprises at least one step in which the temperature is between 20 °C and 60 °C, preferably 20 °C and 50 °C, more preferably 20 °C and 40 °C, more preferably 25 °C and 40 °C, most preferably around 30 °C, preferably the washing process is carried out at a temperature between 20 °C and 60 °C, preferably 20 °C and 50 °C, more preferably, 20 °C and 40 °C, more preferably 25 °C and 40 °C, most preferably around 30 °C.

[0112] In a further aspect, the invention relates to the use of at least one cellulase in combination with at least one protease and at least one amylase and optionally at least one lipase for preventing or removing greying of a fabric, preferably in a washing process, more preferably the enzymes are comprised in a detergent composition or an agent or article as described herein. In particular, the enzyme amounts and ratios are as described above for detergent compositions according to the invention or for compositions used in and described for the method according to the invention.

[0113] All embodiments and examples described herein for the detergent composition according to the invention also apply to the agent, to the article, to the method for preventing or removing greying of a fabric and to the use of at least one cellulase in combination with at least one protease and at least one amylase, and *vice versa*.

[0114] Other embodiments are within the following non-limiting examples.

Examples

[0115]

Table 1: Preferred detergent composition (Gel) according to the invention (detergent composition 3 with 0.1 wt.-% cellulase formulation and enzyme and boric acid optimization).

Raw material	Conc. of the raw material in %	% in the formula a.s.	% in the formula t.q.
Perfume/Fragrances 1	100	0.63	0.63
Dye/Colorants 1	85	0.00085	0.001
Dye/Colorants 2	85	0.00031161	0.0003666
Anionic surfactant Na-LAS		3.60	
Anionic surfactant LAS	96	3.370	3.510174419
Further anionic surfactant	70	6.00	8.571428571
Non-ionic surfactant	100	5.2	5.2
Fatty acids, palm kernel oil (soap)	100	1.6	1.6
Alkalis	48	1.962793039	4.089152164
Citric acid	91.4	1.18	1.291028446
Boric acid	100	0.79	0.7900

(continued)

Raw material	Conc. of the raw material in %	% in the formula a.s.	% in the formula t.q.
Preservatives	7.5	0.0075	0.1
Protease formulation	100	0.3	0.3
Lipase formulation	100	0.2	0.2
Amylase formulation	100	0.12	0.12
Cellulase formulation	100	0.1	0.1
Fluorescent whitening agents	90	0.035	0.0389
Suds control agent	20	0.008	0.04
Rheology modifier	30	0.255	0.85
Glycerin	99	2	2.020
Builder	40	0.2	0.5
Sodium Chloride	98.5	0.2	0.203
Water		75.84	69.845

Table 2: Detergent composition 1 (Gel) without cellulase.

Raw material	Conc. of the raw material in %	% in the formula a.s.	% in the formula t.q.
Perfume/Fragrances 1	100	0.63	0.63
Dye/Colorants 1	85	0.00085	0.001
Dye/Colorants 2	85	0.00031161	0.0003666
Anionic surfactant Na-LAS		3.60	
Anionic surfactant LAS	96	3.370	3.510174419
Further anionic surfactant	70	6.00	8.571428571
Non-ionic surfactant	100	5.2	5.2
Fatty acids, palm kernel oil (soap)	100	1.6	1.6
Alkalis	48	2.098671395	4.372232073
Citric acid	91.4	1.18	1.291028446
Boric acid	100	1	1
Preservatives	7.5	0.0075	0.1
Protease formulation	100	0.55	0.55
Lipase formulation	100	0.125	0.125
Amylase formulation	100	0.1625	0.1625
Mannanase formulation	100	0.0816	0.0816
Fluorescent whitening agents	90	0.035	0.0389
Suds control agent	20	0.008	0.04
Rheology modifier	30	0.255	0.85
Glycerin	99	2	2.020

(continued)

Raw material	Conc. of the raw material in %	% in the formula a.s.	% in the formula t.q.
Builder	40	0.2	0.5
Sodium Chloride	98.5	0.2	0.203
Water		75.30	69.153

Table 3: Acid and enzyme concentrations of liquid laundry detergent compositions with and without cellulase and with optimized acid and enzyme concentrations and ratios.

Raw material	Detergent composition 1 without cellulase	Detergent composition 2 with 0.1 wt.-% cellulase formulation	Detergent composition 3 with 0.1 wt.-% cellulase formulation and enzyme and boric acid optimization
Citric acid	1.3	1.3	1.3
Boric acid	1	1	0.79
Protease formulation	0.55	0.55	0.3
Lipase formulation	0.125	0.125	0.2
Amylase formulation	0.1625	0.1625	0.12
Mannanase formulation	0.0816	0	0
Cellulase formulation	0	0.1	0.1

Table 4: Stability results of detergent composition 3 according to the invention (i.O. means "ok", k.v. means "minimally changed", k.v.-l.v. means "minimally to slightly changed" and l.v. means "slightly changed").

Stability test evaluation of liquid product						
		Standard	before test	4 weeks	8 weeks	12 weeks
Visual control (color, phase stability, ...)	50°C	ok	ok	ok		
	40°C			ok	ok	ok
	Room temp.			ok	ok	ok
	0°C			ok	ok	ok
Perfume evaluation	50°C	ok	i.O.	ok		
	40°C			ok	k.v.-l.v.	ok
	Room temp.			ok	k.v.	ok
	0°C			ok	k.v.	ok
pH	50°C	8.4 ± 0.2	8.38	8.26		
	40°C			8.39	8.43	8.36
	Room temp.			8.34	8.62	8.48
	0°C			8.46	8.39	8.54

(continued)

Stability test evaluation of liquid product						
		Standard	before test	4 weeks	8 weeks	12 weeks
Viscosity (mPas)	50°C	1500 mPas ± 400	1660	1340		
	40°C			1380	1610	1550
	Room temp.			1390	1360	1380
	0°C			1270	1440	1330
Cloud point	50°C	<0	<0	<-5		
	40°C			<-5	<-5	<-5
	Room temp.			-4	<-5	<-5
	0°C			<-5	<-5	<-5

[0116] The following non-limiting figures are comprised:

Fig. 1 shows the whitening and rewhitening results (Y-value) of using detergent compositions with cellulase (detergent composition 2 with 0.1 wt.-% cellulase formulation) and without cellulase (detergent compositions 1 and 4) for different textiles after 20 wash cycles at 30°C and a water hardness of 16dH. Detergent compositions 1 and 2 have nearly the same composition with the exception of 0.1 wt.-% cellulase formulation instead of mannanase formulation. Detergent composition 4 is another reference detergent composition.

Fig. 2 shows the whitening and rewhitening results (Y-value) of using detergent compositions without cellulase (detergent compositions 1 and 4) and with cellulase (0.1 wt.-% cellulase formulation) and enzyme and boric acid optimization (detergent composition 3) for different textiles after 20 wash cycles at 30°C and a water hardness of 16dH. Detergent compositions 1 and 3 have nearly the same composition with the exception of 0.1 wt.-% cellulase formulation instead of mannanase formulation, and enzyme and boric acid optimization. Detergent composition 4 is another reference detergent composition.

Fig. 3A shows the anti-greying results (Y-value) of using detergent compositions with cellulase (detergent composition 2 with 0.1 wt.-% cellulase formulation) and without cellulase (detergent compositions 1 and 4) for different textiles after 20 wash cycles at 30°C and a water hardness of 16dH (Test stripe A). Detergent compositions 1 and 2 have nearly the same composition with the exception of 0.1 wt.-% cellulase formulation instead of mannanase formulation. Detergent composition 4 is another reference detergent composition.

Fig. 3B shows the anti-greying results (Y-value) of using detergent compositions with cellulase (detergent composition 2 with 0.1 wt.-% cellulase formulation) and without cellulase (detergent compositions 1 and 4) for different textiles after 20 wash cycles at 30°C and a water hardness of 16dH (Test stripe B). Detergent compositions 1 and 2 have nearly the same composition with the exception of 0.1 wt.-% cellulase formulation instead of mannanase formulation. Detergent composition 4 is another reference detergent composition.

Fig. 3C shows the anti-greying results (Y-value) of using detergent compositions without cellulase (detergent compositions 1 and 4) and with cellulase (0.1 wt.-% cellulase formulation) and enzyme and boric acid optimization (detergent composition 3) for different textiles after 20 wash cycles at 30°C and a water hardness of 16dH (Test stripe A). Detergent compositions 1 and 3 have nearly the same composition with the exception of 0.1 wt.-% cellulase formulation instead of mannanase formulation, and enzyme and boric acid optimization. Detergent composition 4 is another reference detergent composition.

Fig. 3D shows the anti-greying results (Y-value) of using detergent compositions without cellulase (detergent compositions 1 and 4) and with cellulase (0.1 wt.-% cellulase formulation) and enzyme and boric acid optimization (detergent composition 3) for different textiles after 20 wash cycles at 30°C and a water hardness of 16dH (Test stripe B). Detergent compositions 1 and 3 have nearly the same composition with the exception of 0.1 wt.-% cellulase

formulation instead of mannanase formulation, and enzyme and boric acid optimization. Detergent composition 4 is another reference detergent composition.

Fig. 4 shows the visible anti-greying and rewhitening results of using compositions without cellulase (reference detergent composition 6) and with cellulase (0.1 wt.-% cellulase formulation) and enzyme and boric acid optimization (detergent composition 3) on textiles after 20 wash cycles at 30°C and a water hardness of 16dH. Detergent composition 6 is another reference detergent composition. "Reference" means unwashed greyed fabric.

Fig. 5A shows an overview over the anti-greying protection results of Figs. 1, 3A and 3B (washing conditions: after 20 wash cycles, 30°C, 16dH). Detergent composition 2 is superior over detergent composition 1 on 7 fabrics, tangentially superior on 7 fabrics, tangentially inferior on 5 fabrics and inferior on 3 fabrics, parity on 2 fabrics. Detergent compositions 1 and 2 have nearly the same composition with the exception of 0.1 wt.-% cellulase formulation instead of mannanase formulation.

Fig. 5B shows an overview over the anti-greying protection results of Figs. 2, 3C and 3D (washing conditions: after 20 wash cycles, 30°C, 16dH). Detergent composition 3 is superior over detergent composition 1 on 11 fabrics, tangentially superior on 6 fabrics, tangentially inferior on 5 fabrics and inferior on 1 fabric, parity on 1 fabric. Detergent compositions 1 and 3 have nearly the same composition with the exception of 0.1 wt.-% cellulase formulation instead of mannanase formulation, and enzyme and boric acid optimization. The results of Figs. 5A and 5B demonstrate that composition 3 is significantly better regarding anti-greying protection than composition 2 over composition 1.

Fig. 6 shows the washing performance of (6A) detergent composition 1 in comparison to a reference detergent composition 5 for a total of 35 stains (stain monitors used: Equest MEA-Set 2021, Monitor Global Core Stain Set 2020-1, SAM-MEA 2 CO) (regarding 5 stains, detergent composition 1 shows better washing performance than detergent composition 5 (right side), and regarding 3 stains detergent composition 5 is better than detergent 1 (left side), parity for 27 stains, in conclusion, detergent compositions 1 and 5 show similar washing performance); and (6B) detergent composition 3 with cellulase (0.1 wt.-% cellulase formulation) and enzyme and boric acid optimization in comparison to reference detergent composition 5 for a total of 35 stains (stain monitors used: Equest MEA-Set 2021, Monitor Global Core Stain Set 2020-1, SAM-MEA 2 CO) (regarding 3 stains, detergent composition 3 shows a better washing performance than detergent composition 5 (right side) and regarding 5 stains detergent 5 is better (left side), parity for 27 stains, in conclusion, detergent compositions 3 and 5 show similar washing performance) (washing conditions: washing dosage 100 g, 30°C, 16dH). Detergent compositions 1 and 3 have nearly the same composition with the exception of 0.1 wt.-% cellulase formulation instead of mannanase formulation, and enzyme and boric acid optimization. Detergent composition 5 is another reference detergent composition without cellulase.

Claims

1. Detergent composition comprising

a) at least one protease in an amount of from 0.001 to 0.1 wt.-%,
b) at least one amylase in an amount of from 0.0001 to 0.01 wt.-%, and
c) at least one cellulase in an amount of from 0.0001 to 0.01 wt.-%,

each based on the active protein content and the total weight of the detergent composition, wherein the weight ratio of the amount of protease to cellulase is in the range of from 97:3 to 80:20; the weight ratio of the amount of protease to amylase is in the range of from 95:5 to 75:25;
and the weight ratio of the amount of amylase to cellulase is in the range of from 80:20 to 60:40.

2. The detergent composition according to claim 1, wherein the composition further comprises d) at least one lipase.

3. The detergent composition according to claim 1 or 2, wherein the composition comprises

a) the at least one protease in an amount of from 0.001 to 0.05 wt.-%, preferably 0.001 to 0.03 wt.-%, more preferably 0.005 to 0.029 wt.-%, more preferably 0.01 to 0.026 wt.-%, for example equal to or less than 0.024 wt.-%, most preferably 0.01 to 0.023 wt.-%, for example equal to or less than 0.02 wt.-% or equal to or less than 0.018 wt.-%; and/or
b) the at least one amylase in an amount of from 0.0001 to 0.005 wt.-%, preferably 0.001 to 0.005 wt.- %, more

preferably 0.001 to 0.004 wt.-%, for example equal to or less than 0.0034 wt.-%, most preferably 0.001 to 0.0033 wt.-%, for example equal to or less than 0.003 wt.-% or equal to or less than 0.0028 wt.-%; and/or
c) the at least one cellulase in an amount of from 0.0001 to 0.008 wt.-%, preferably 0.0001 to 0.003 wt.- %, more preferably 0.0005 to 0.0025 wt.-%, for example 0.0006 to 0.002 wt.-% or 0.0006 to 0.0015 wt.- %; and/or
d) optionally the at least one lipase in an amount of from 0.0001 to 0.1 wt.-%, preferably 0.0005 to 0.01 wt.-%, more preferably 0.001 to 0.01 wt.-%, for example equal to or more than 0.003 wt.-% or equal to or more than 0.0033 wt.-%, most preferably 0.0033 to 0.008 wt.-%;

each based on the active protein content and the total weight of the detergent composition.

4. The detergent composition according to claim 2 or 3, wherein the composition comprises

i) higher levels of protease than lipase; and/or
ii) higher levels of lipase than amylase; and/or
iii) higher levels of lipase than cellulase; and/or
iv) higher levels of protease, amylase and lipase than cellulase; and/or
v) higher levels of protease than amylase, cellulase and lipase;

each based on the active protein content and the total weight of the detergent composition.

5. The detergent composition according to any one of the preceding claims, wherein the composition comprises

i) the at least one protease and the at least one cellulase in a weight ratio of 96:4 to 85:15, preferably 95:5 to 88:12, more preferably 95:5 to 90:10, most preferably 95:5 to 92:8, based on the active protein content of the at least one protease and the at least one cellulase in the detergent composition; and/or
ii) the at least one amylase and the at least one cellulase in a weight ratio of 78:22 to 65:35, preferably 77:23 to 68:32, more preferably 76:24 to 70:30, most preferably 76:24 to 72:28, based on the active protein content of the at least one amylase and the at least one cellulase in the detergent composition; and/or
iii) the at least one protease and the at least one amylase in a weight ratio of 90:10 to 80:20, preferably 88:12 to 81:19, most preferably 86:14 to 82:18, based on the active protein content of the at least one protease and the at least one amylase in the detergent composition; and/or
iv) the at least one protease and amylase together and the at least one cellulase in a weight ratio of 99.9:0.1 to 70:30, preferably 99:1 to 75:25, more preferably 98:2 to 80:20, more preferably 98:2 to 85:1, more preferably 97:3 to 90:10, most preferably 96:4 to 91:9, based on the active protein content of the at least one protease and the at least one amylase together and the at least one cellulase in the detergent composition; and/or
v) optionally the at least one lipase and the at least one cellulase in a weight ratio of 99.9:0.1 to 60:40, preferably 99:1 to 65:35, more preferably 95:5 to 70:30, more preferably 93:7 to 75:25 wt.-%, more preferably 90:10 to 78:22, more preferably 89:11 to 80:20, most preferably 89:11 to 82:18, based on the active protein content of the at least one lipase and the at least one cellulase in the detergent composition; and/or
vi) optionally the at least one protease, amylase and lipase together and the at least one cellulase in a weight ratio of 99.99:0.01 to 80:20, preferably 99.9:0.1 to 85:15, more preferably 99:1 to 88:12, more preferably 98:2 to 90:10, most preferably 97:3 to 92:8, based on the active protein content of the at least one protease, the at least one amylase and the at least one lipase together and the at least one cellulase in the detergent composition.

6. The detergent composition according to any one of the preceding claims, wherein

i) the weight ratio of the amount of protease to amylase is in the range of from 86:14 to 82:18, the weight ratio of the amount of protease to cellulase is in the range of from 95:5 to 90:10 and the weight ratio of the amount of amylase to cellulase is in the range of from 76:24 to 70:30; and, optionally,
ii) the weight ratio of the amount of protease to amylase is in the range of from 86:14 to 82:18, the weight ratio of the amount of protease to cellulase is in the range of from 95:5 to 90:10, the weight ratio of the amount of amylase to cellulase is in the range of from 76:24 to 70:30, the weight ratio of the amount of lipase to cellulase is in the range of from 89:11 to 80:20, the weight ratio of the amount of lipase to protease is in the range of from 78:22 to 65:35, and the weight ratio of the amount of lipase to amylase is in the range of from 72:28 to 65:35; and/or
iii) the composition comprises the at least one protease in an amount of less than 0.024 wt.-%, preferably of from 0.01 to 0.023 wt.-%, the at least one amylase in an amount of less than 0.0034 wt.-%, preferably of from 0.001 to 0.0033 wt.-%, and the at least one cellulase in an amount of from 0.0005 to 0.0025 wt.- %, preferably 0.0006 to 0.002 wt.-%, and, optionally, the at least one lipase in an amount of equal to or more than 0.0033 wt.-

%, most preferably 0.0033 to 0.008 wt.-%;

each based on the active protein content and the total weight of the detergent composition.

7. The detergent composition according to any one of the preceding claims, wherein the composition is free of a mannanase, preferably the composition is free of any further enzyme.

8. The detergent composition according to any one of the preceding claims, wherein the protease comprises or consists of an amino acid sequence having at least 70%, preferably at least 80%, more preferably at least 90%, more preferably at least 92%, most preferably at least 98% sequence identity to the amino acid sequence set forth in SEQ ID NO: 1 over the total length, wherein the amino acid sequence comprises

(i) at at least one of the positions, preferably at at least two or at at least three of the positions, more preferably at four of the positions, corresponding to positions 3, 4, 99 or 199 at least one, preferably at least two or at least three, most preferably four, amino acid substitutions selected from S3T, V4I, R99E and V199I; and, optionally,
(ii) at at least one of the positions corresponding to positions 74, 136, 143, 154, 160, 161, 163, 171, 181, 183, 185, 200, 203, 209, 212 or 256 at least one further amino acid substitution, in particular selected from N74D/E/Q, A136Q, R143L/W/Y, S154D/Q, S160G, Y161T, A163G, V171L, A181D, F183R, Q185R, Q200A/L/S/T, Y203K/V/W, A209K/W, N212S/T and L256D/E/Q;

based on the numbering of SEQ ID NO:1 over its total length.

9. The detergent composition according to any one of the preceding claims, wherein the amylase having amylolytic activity is selected from

a) an α-amylase comprising an amino acid sequence having at least 80%, preferably at least 81%, 82%, 83%, 84%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98% or 99% sequence identity to the amino acid sequence set forth in SEQ ID NO: 2 over the total length, and optionally comprising at least one amino acid substitution at at least one of the positions corresponding to positions 172, 202, 208, 255 and 261 of SEQ ID NO: 2, preferably selected from M202L, M202V, M202S, M202T, M202I, M202Q, M202W, S255N, R172Q and combinations thereof; and/or
b) an α-amylase comprising an amino acid sequence having at least 60%, preferably at least 61%, 62%, 63%, 64%, 65%, 66%, 67%, 68%, 69%, 79%, 71%, 72%, 73%, 74%, 75%, 76%, 77%, 78%, 79%, 80%, 81%, 82%, 83%, 84%, 85%, 86%, 87%, 88%, 89%, 90%, 90,5%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98% or 99% sequence identity to the amino acid sequence set forth in SEQ ID NO:3 over the total length, and optionally comprising at least one amino acid substitution at at least one position corresponding to positions 9, 26, 30, 33, 82, 37, 106, 118, 128, 133, 149, 150, 160, 178, 182, 186, 193, 195, 202, 203, 214, 231, 256, 257, 258, 269, 270, 272, 283, 295, 296, 298, 299, 303, 304, 305, 311, 314, 315, 318, 319, 320, 323, 339, 345, 361, 378, 383, 419, 421, 437, 441, 444, 445, 446, 447, 450, 458, 461, 471, 482 and 484 of SEQ ID NO:3 and/or a deletion at at least one of the positions 183 and 184 of SEQ ID NO:3, preferably at least one amino acid substitution at at least one of the positions 9, 26, 149, 182, 186, 202, 257, 295, 299, 323, 339 and 345, and/or more preferably at least one amino acid substitution or amino acid deletion selected from R118K, D183*, G184*, N195F, R320K, R458K and combinations thereof; and/or
c) an α-amylase comprising an amino acid sequence having at least 65%, preferably at least 66%, 67%, 68%, 69%, 79%, 71%, 72%, 73%, 74%, 75%, 76%, 77%, 78%, 79%, 80%, 81%, 82%, 83%, 84%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98% or 99% sequence identity to the amino acid sequence set forth in SEQ ID NO: 4 over the total length, and optionally having at least one substitution and/or deletion at at least one of the positions corresponding to positions 93, 116, 118, 129, 133, 134, 140, 142, 146, 147, 149, 151, 152, 169, 174, 183, 184, 186, 189, 193, 195, 197, 198, 200, 203, 206, 210, 212, 213, 235, 243, 244, 260, 262, 284, 303, 304, 320, 338, 347, 359, 418, 431, 434, 439, 447, 458, 469, 476 and 477 of SEQ ID NO:4, preferably amino acid deletions at the positions corresponding to positions 183 and 184; and/or
d) an α-amylase comprising an amino acid sequence having at least 89%, preferably at least 90%, 90.5%, 91%, 91.5%, 92%, 92.5%, 93%, 93.5%, 94%, 94.5%, 95%, 95.5%, 96%, 96.5%, 97%, 97.5%, 98%, 98.5% or 99% sequence identity to the amino acid sequence set forth in SEQ ID NO:5 over the total length and having at least one deletion at at least one of the positions corresponding to positions 180, 181, 182, 183 and 184 of SEQ ID NO:5, preferably deletions at at least two positions selected from positions 180+181, 181+182, 182+183 and 183+184 of SEQ ID NO:5, more preferably at positions 183+184 of SEQ ID NO:5, and/or at least one substitution at at least one of the positions corresponding to positions 405, 421, 422 and 428 of SEQ ID NO:5 selected from

1405L, A421H, A422P, A428T and combinations thereof.

10. The detergent composition according to any one of the preceding claims, wherein the composition further comprises at least one acid, preferably citric acid and/or boric acid.

11. The detergent composition according to claim 10, wherein

(i) the at least one acid, preferably at least two acids, is/are comprised in the composition in an amount of from 0.01 to 15 wt.-%, preferably 0.1 to 10 wt.-%, more preferably 0.1 to 5 wt.-%, more preferably 0.5 to 4 wt.-%, more preferably 0.9 to 3 wt.-%, most preferably in an amount of less than 2.3 wt.-%, for example less than 2.2 wt.-% such as 2.09 wt.-%, based on the total weight of the detergent composition; and/or
(ii) boric acid is comprised in the detergent composition in an amount of from 0.01 to 15 wt.-%, preferably 0.1 to 10 wt.-%, more preferably 0.1 to 5 wt.-%, more preferably 0.1 to 3 wt.-%, more preferably 0.1 to 2 wt.-%, more preferably in an amount of less than 1 wt.-%, more preferably less than 0.9 wt.-%, more preferably less than 0.88 wt.-%, more preferably less than 0.85 wt.-%, most preferably less than 0.8 wt.- % such as 0.79 wt.-%, based on the total weight of the detergent composition.

12. The detergent composition according to any one of the preceding claims, wherein the composition comprises at least one surfactant, preferably at least one anionic and/or nonionic surfactant, more preferably in an amount of from 1 to 50 wt.-%, preferably 2 to 35 wt.-%, more preferably 5 to 35 wt.-%, most preferably 10 to 30 wt.-%, based on the total weight of the detergent composition.

13. The detergent composition according to any one of the preceding claims, wherein the composition is a liquid laundry detergent composition.

14. A method for preventing or removing greying of a fabric, comprising
contacting said fabric with a composition comprising at least one cellulase, at least one protease and at least one amylase and, optionally, at least one lipase, preferably with a detergent composition according to any one of claims 1 to 13, in particular during a washing process.

15. Use of at least one cellulase in combination with at least one protease and at least one amylase and, optionally, at least one lipase for preventing or removing greying of a fabric, preferably in a washing process, more preferably the enzymes are comprised in a detergent composition according to any one of claims 1 to 13.

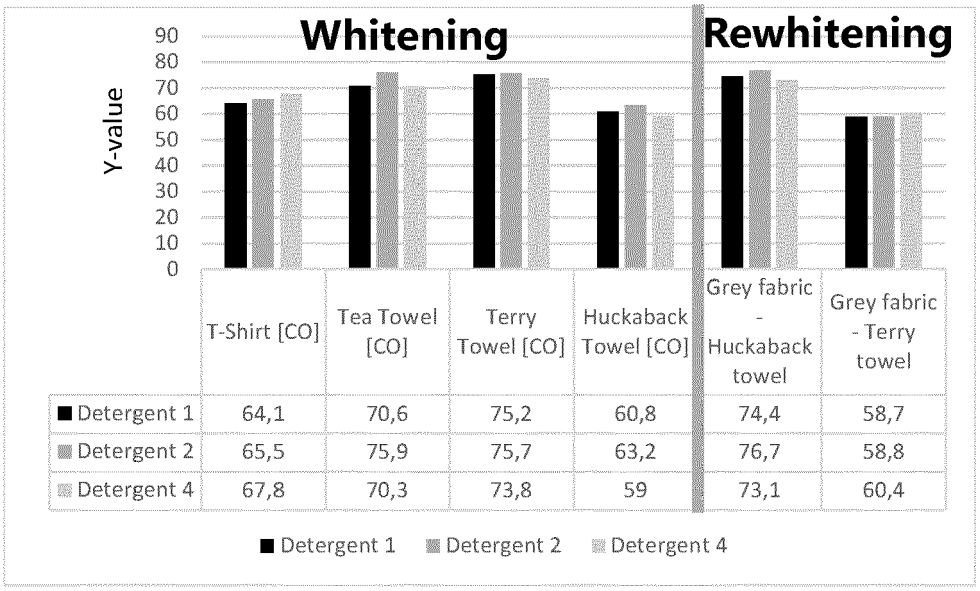
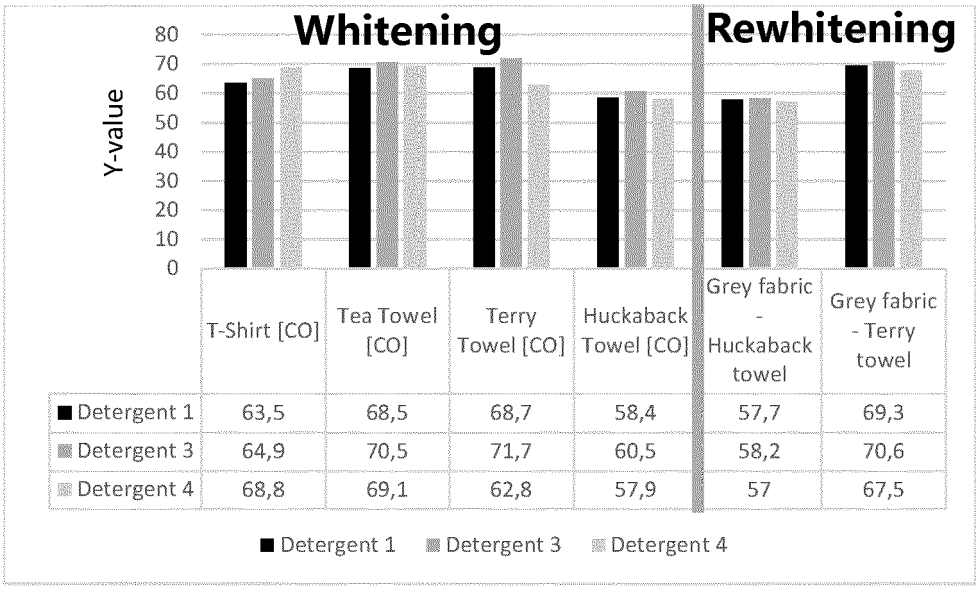

Whitening
Rewhitening
Y-value
90
80
70
60
50
40
30
20
10
0
T-Shirt [CO]
Tea Towel [CO]
Terry Towel [CO]
Huckaback Towel [CO]
Grey fabric - Huckaback towel
Grey fabric - Terry towel
Detergent 1 64,1 70,6 75,2 60,8 74,4 58,7
Detergent 2 65,5 75,9 75,7 63,2 76,7 58,8
Detergent 4 67,8 70,3 73,8 59 73,1 60,4
Detergent 1
Detergent 2
Detergent 4

Fig. 1


Whitening
Rewhitening
Y-value
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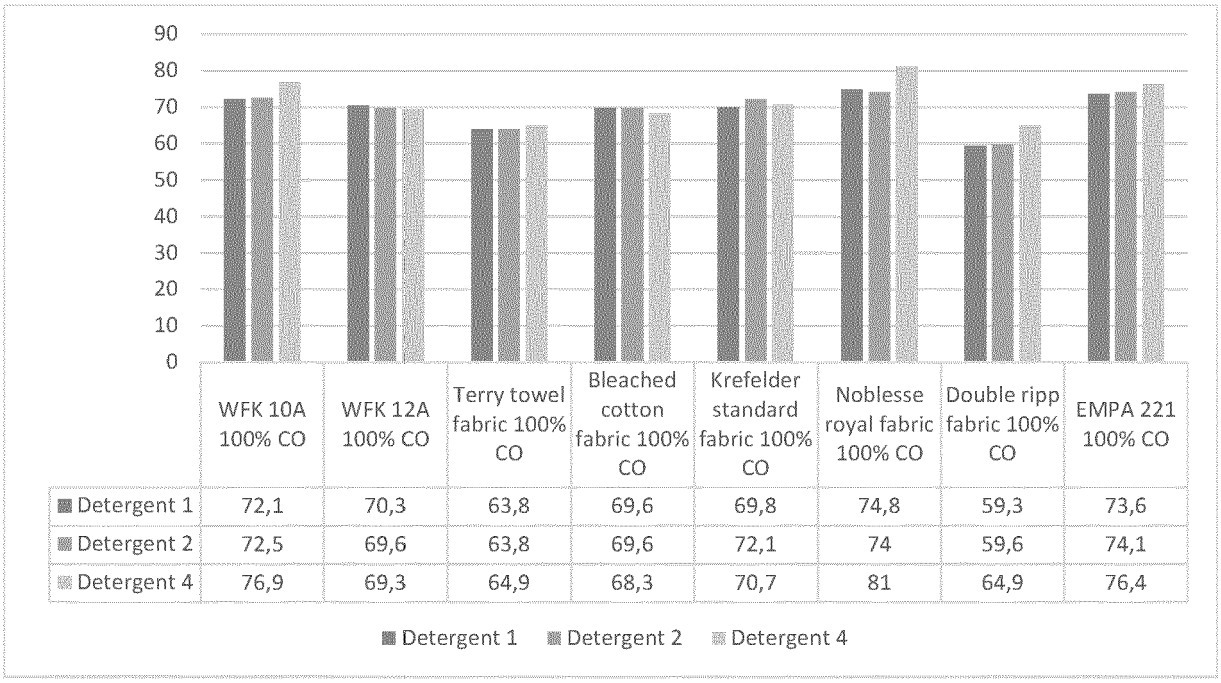
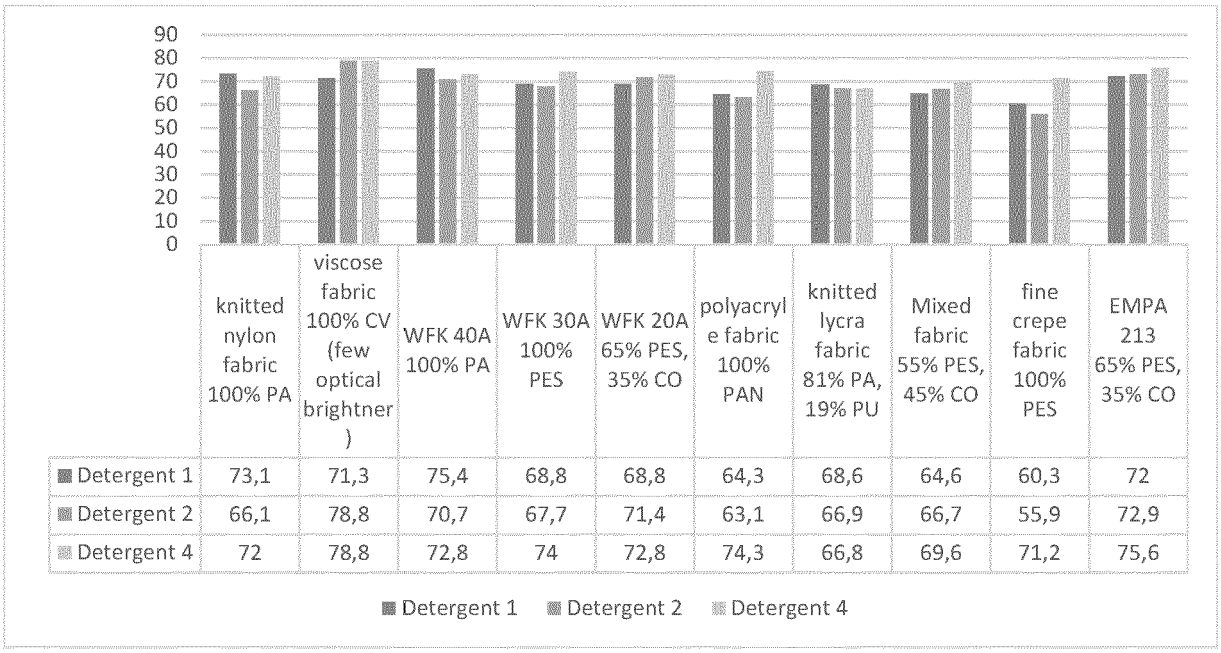
70
60
50
40
30
20
10
0
T-Shirt [CO]
Tea Towel [CO]
Terry Towel [CO]
Huckaback Towel [CO]
Grey fabric - Huckaback towel
Grey fabric - Terry towel
Detergent 1 63,5 68,5 68,7 58,4 57,7 69,3
Detergent 3 64,9 70,5 71,7 60,5 58,2 70,6
Detergent 4 68,8 69,1 62,8 57,9 57 67,5
Detergent 1
Detergent 3
Detergent 4

Fig. 2



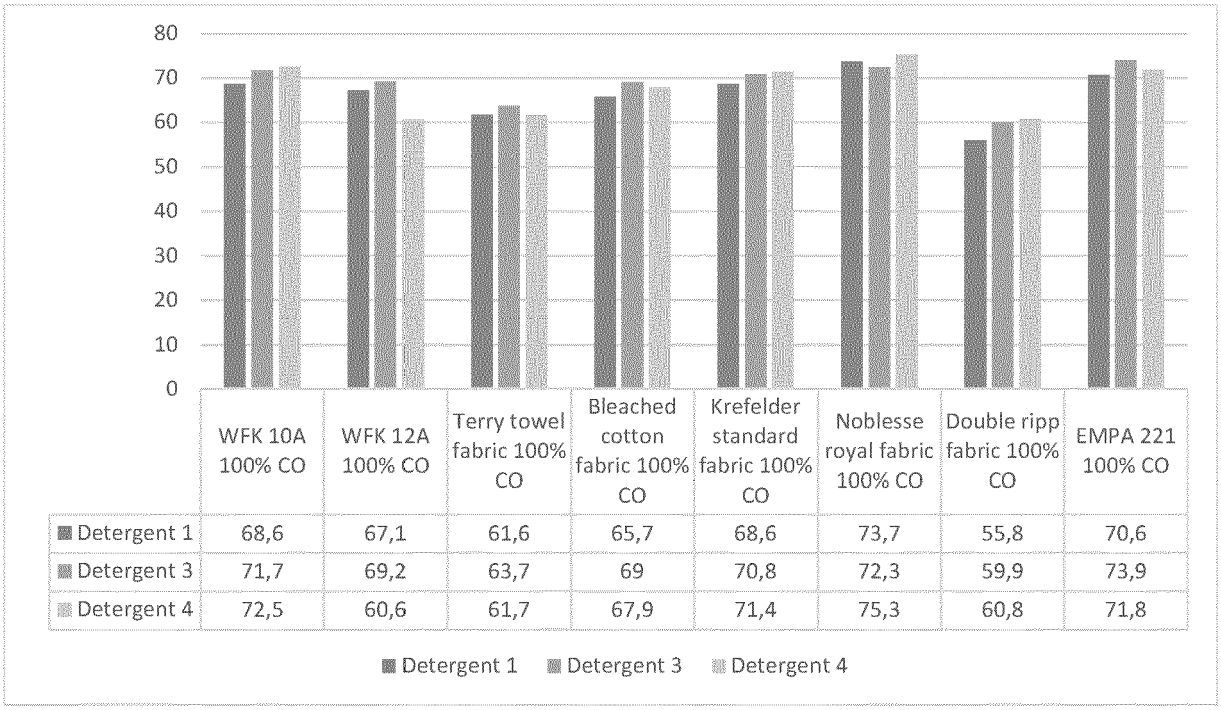
	WFK 10A 100% CO	WFK 12A 100% CO	Terry towel fabric 100% CO	Bleached cotton fabric 100% CO	Krefelder standard fabric 100% CO	Noblesse royal fabric 100% CO	Double ripp fabric 100% CO	EMPA 221 100% CO
Detergent 1	72,1	70,3	63,8	69,6	69,8	74,8	59,3	73,6
Detergent 2	72,5	69,6	63,8	69,6	72,1	74	59,6	74,1
Detergent 4	76,9	69,3	64,9	68,3	70,7	81	64,9	76,4

Fig. 3A



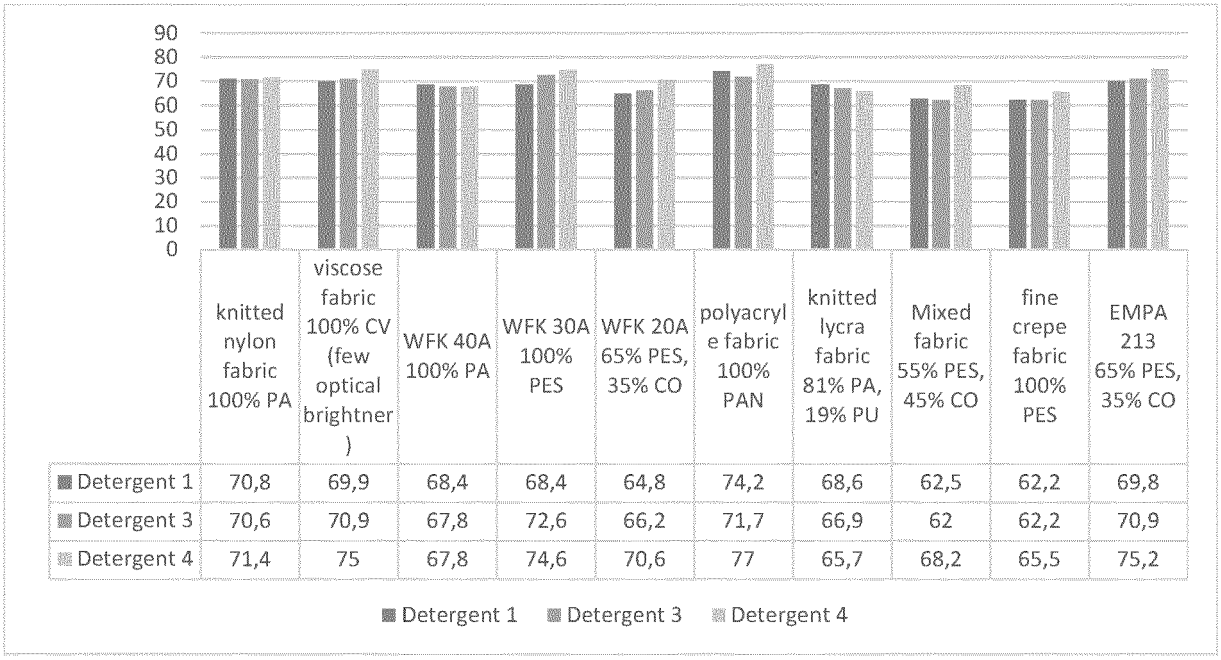
	knitted nylon fabric 100% PA	viscose fabric 100% CV (few optical brightner)	WFK 40A 100% PA	WFK 30A 100% PES	WFK 20A 65% PES, 35% CO	polyacrylic fabric 100% PAN	knitted lycra fabric 81% PA, 19% PU	Mixed fabric 55% PES, 45% CO	fine crepe fabric 100% PES	EMPA 213 65% PES, 35% CO
Detergent 1	73,1	71,3	75,4	68,8	68,8	64,3	68,6	64,6	60,3	72
Detergent 2	66,1	78,8	70,7	67,7	71,4	63,1	66,9	66,7	55,9	72,9
Detergent 4	72	78,8	72,8	74	72,8	74,3	66,8	69,6	71,2	75,6

Fig. 3B



	WFK 10A 100% CO	WFK 12A 100% CO	Terry towel fabric 100% CO	Bleached cotton fabric 100% CO	Krefelder standard fabric 100% CO	Noblesse royal fabric 100% CO	Double ripp fabric 100% CO	EMPA 221 100% CO
Detergent 1	68,6	67,1	61,6	65,7	68,6	73,7	55,8	70,6
Detergent 3	71,7	69,2	63,7	69	70,8	72,3	59,9	73,9
Detergent 4	72,5	60,6	61,7	67,9	71,4	75,3	60,8	71,8

Fig. 3C



	knitted nylon fabric 100% PA	viscose fabric 100% CV (few optical brightner)	WFK 40A 100% PA	WFK 30A 100% PES	WFK 20A 65% PES, 35% CO	polyacrylic fabric 100% PAN	knitted lycra fabric 81% PA, 19% PU	Mixed fabric 55% PES, 45% CO	fine crepe fabric 100% PES	EMPA 213 65% PES, 35% CO
Detergent 1	70,8	69,9	68,4	68,4	64,8	74,2	68,6	62,5	62,2	69,8
Detergent 3	70,6	70,9	67,8	72,6	66,2	71,7	66,9	62	62,2	70,9
Detergent 4	71,4	75	67,8	74,6	70,6	77	65,7	68,2	65,5	75,2

Fig. 3D

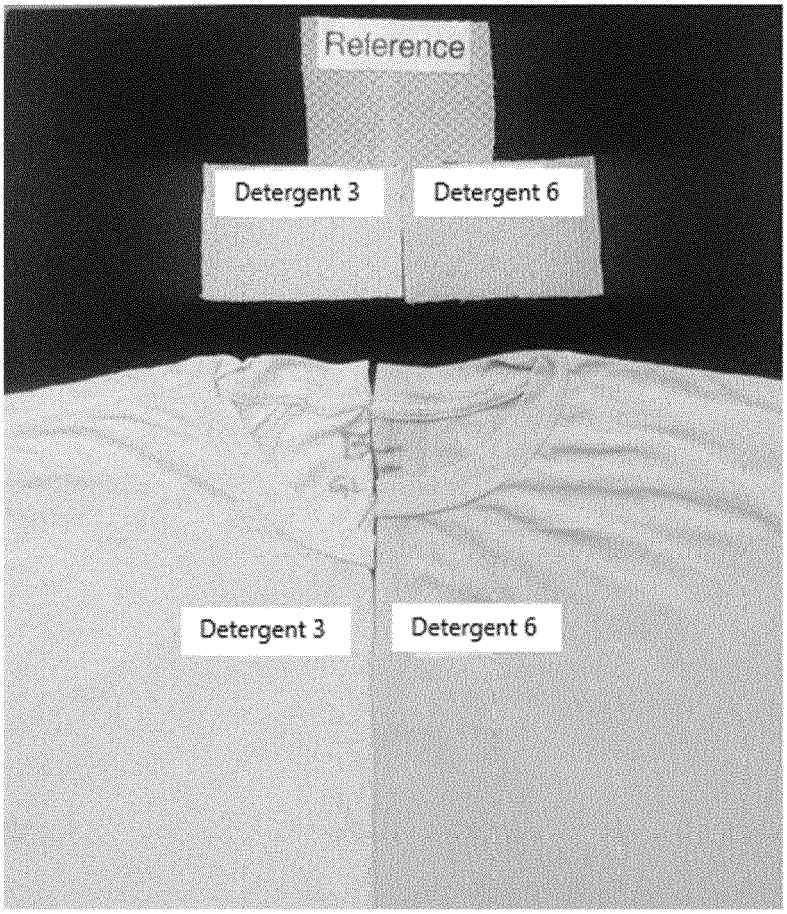


Fig. 4

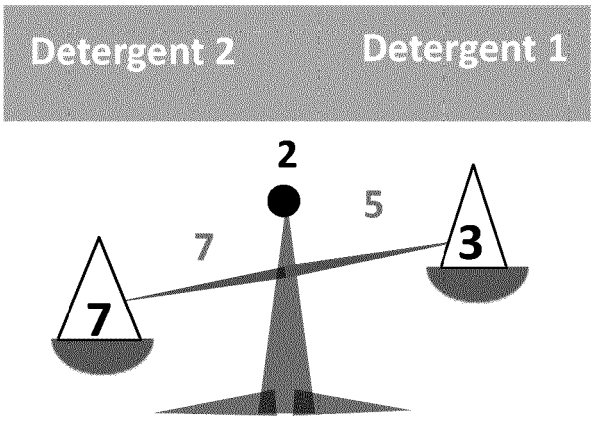


Fig. 5A

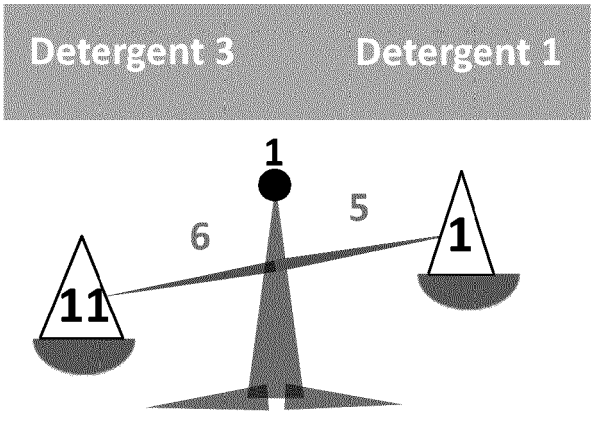


Fig. 5B

Detergent 1 (100g)		
Detergent 5 (100g)		
3	27	5
red wine (not aged) GCS beef fat (colored) GCS axle grease EMS		salad dressing w/ natural black GCS ice cream: chocolate GCS grass GCS full egg w/ carbon black GCS blood (aged) GCS

Fig. 6A

Detergent 3 (100g)		
Detergent 5 (100g)		
5	27	3
sebum w/ carbon black GCS salad dressing w/ natural black GCS red wine (not aged) GCS beef fat (colored) GCS axle grease EMS		mineral oil / carbon black GCS full egg w/ carbon black GCS blood (aged) GCS

Fig. 6B

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