(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) **World Intellectual Property Organization**
International Bureau

(43) **International Publication Date**
3 November 2016 (03.11.2016)

WIPO | PCT

(10) **International Publication Number**
WO 2016/176282 A1

(51) **International Patent Classification**:
C11D 3/386 (2006.01)

(21) **International Application Number**:
PCT/US2016/029482

(22) **International Filing Date**:
27 April 2016 (27.04.2016)

(25) **Filing Language**: English

(26) **Publication Language**: English

(30) **Priority Data**:
15165813.5 29 April 2015 (29.04.2015) EP
15190046.1 15 October 2015 (15.10.2015) EP

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(81) **Designated States** *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) **Designated States** *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Published:
— *with international search report (Art. 21(3))*
— *with sequence listing part of description (Rule 5.2(a))*

(54) **Title**: METHOD OF TREATING A FABRIC

(57) **Abstract**: A method of treating a fabric, comprising contacting the fabric with an aqueous liquor comprising a fabric care component selected from the group consisting of cationic softening-compounds, silicone softening-compounds, paraffins, dispersible polyolefins, waxes and mixtures thereof; and contacting the fabric with an aqueous liquor comprising a nuclease enzyme, preferably a deoxyribonuclease or ribonuclease enzyme. The aqueous liquor may be provided by adding a cleaning or treatment composition to water. Preferably the composition

METHOD OF TREATING A FABRIC

FIELD OF THE INVENTION

The present invention relates to methods of treating fabrics.

BACKGROUND OF THE INVENTION

Fabric care components are often added by manufacturers to fabric treatment and/or cleaning compositions and/or by consumers, to the laundering process, especially during the rinse step of a fabric washing operation. Fabric care compositions deposit on to fabrics and impart a number of sensorial benefits that consumers enjoy, including softness, skin care and freshness. Most frequently, softness is provided by esterified cationic surfactants and/or silicones. It is also known to add cellulase enzymes into such compositions for example as described in WO95/005442.

However, fabrics treated with fabric care compositions can be more easily soiled and/or more difficult to clean in a subsequent wash step due to adhesion of body soils and other oily soils to the fabric care chemistry. There is a need to improve cleaning of fabrics comprising fabric care chemistry especially at low wash temperatures and/or at short wash cycles. The present inventors have found that compositions comprising nuclease enzymes are especially effective at cleaning fabrics having a fabric care composition thereon.

SUMMARY OF THE INVENTION

The present invention provides a method of treating a fabric, comprising:

(i) contacting a fabric with an aqueous liquor comprising a fabric care component selected from the group consisting of cationic softening-compounds, silicone softening-compounds, paraffins, waxes, dispersible polyolefins and mixtures thereof;

(ii) contacting the fabric with an aqueous liquor comprising a nuclease enzyme, preferably a deoxyribonuclease and/or ribonuclease enzyme.

Steps (i) and (ii) may be simultaneous or sequential in that order.

DETAILED DESCRIPTION OF THE INVENTION

Definitions

As used herein, the term “alkoxy” is intended to include C1-C8 alkoxy and C1-C8 alkoxy derivatives of polyols having repeating units such as butylene oxide, glycidol oxide, ethylene oxide or propylene oxide.

As used herein, unless otherwise specified, the terms “alkyl” and “alkyl capped” are intended to include C1-C18 alkyl groups, and even C1-C6 alkyl groups.

As used herein, unless otherwise specified, the term “aryl” is intended to include C3-12 aryl groups.

As used herein, unless otherwise specified, the term “arylalkyl” and “alkaryl” are equivalent and are each intended to include groups comprising an alkyl moiety bound to an aromatic moiety, typically having C1-C18 alkyl groups and, in one aspect, C1-C6 alkyl groups.

The terms “ethylene oxide,” “propylene oxide” and “butylene oxide” may be shown herein by their typical designation of “EO,” “PO” and “BO,” respectively.

As used herein, the term “cleaning and/or treatment composition” includes, unless otherwise indicated, granular, powder, liquid, gel, paste, unit dose, bar form and/or flake type washing agents and/or fabric treatment compositions, including but not limited to products for laundering fabrics, fabric softening compositions, fabric enhancing compositions, fabric freshening compositions, and other products for the care and maintenance of fabrics, and combinations thereof. Such compositions may be pre-treatment compositions for use prior to a washing step or may be rinse added compositions, as well as cleaning auxiliaries, such as bleach additives and/or "stain-stick" or pre-treat compositions or substrate-laden products such as dryer added sheets.

As used herein, “cellulosic substrates” are intended to include any substrate which comprises cellulose, either 100% by weight cellulose or at least 20% by weight, or at least 30 % by weight or at least 40 or at least 50 % by weight or even at least 60 % by weight cellulose. Cellulose may be found in wood, cotton, linen, jute, and hemp. Cellulosic substrates may be in the form of powders, fibers, pulp and articles formed from powders, fibers and pulp. Cellulosic fibers, include, without limitation, cotton, rayon (regenerated cellulose), acetate (cellulose acetate), triacetate (cellulose triacetate), and mixtures thereof. Typically cellulosic substrates comprise cotton. Articles formed from cellulosic fibers include textile articles such as fabrics. Articles formed from pulp include paper.

As used herein, the term “maximum extinction coefficient” is intended to describe the molar extinction coefficient at the wavelength of maximum absorption (also referred to herein as the maximum wavelength), in the range of 400 nanometers to 750 nanometers.

As used herein “average molecular weight” is reported as an average molecular weight, as determined by its molecular weight distribution: as a consequence of their manufacturing process, polymers disclosed herein may contain a distribution of repeating units in their polymeric moiety.

As used herein the term "variant" refers to a polypeptide that contains an amino acid sequence that differs from a wild type or reference sequence. A variant polypeptide can differ from the wild type or reference sequence due to a deletion, insertion, or substitution of a nucleotide(s) relative to said reference or wild type nucleotide sequence. The reference or wild type sequence can be a full-length native polypeptide sequence or any other fragment of a full-length polypeptide sequence. A polypeptide variant generally has at least about 70% amino acid sequence identity with the reference sequence, but may include 75% amino acid sequence identity within the reference sequence, 80% amino acid sequence identity within the reference sequence, 85% amino acid sequence identity with the reference sequence, 86% amino acid sequence identity with the reference sequence, 87% amino acid sequence identity with the reference sequence, 88% amino acid sequence identity with the reference sequence, 89% amino acid sequence identity with the reference sequence, 90% amino acid sequence identity with the reference sequence, 91% amino acid sequence identity with the reference sequence, 92% amino acid sequence identity with the reference sequence, 93% amino acid sequence identity with the reference sequence, 94% amino acid sequence identity with the reference sequence, 95% amino acid sequence identity with the reference sequence, 96% amino acid sequence identity with the reference sequence, 97% amino acid sequence identity with the reference sequence, 98% amino acid sequence identity with the reference sequence, 98.5% amino acid sequence identity with the reference sequence or 99% amino acid sequence identity with the reference sequence.

As used herein, articles such as “a” and “an” when used in a claim, are understood to mean one or more of what is claimed or described.

As used herein, the terms “include/s”and “including” are meant to be non-limiting.

As used herein, the term “solid” includes granular, powder, bar and tablet product forms.

As used herein, the term “fluid” includes liquid, gel, paste and gas product forms.

Unless otherwise noted, all component or composition levels are in reference to the active portion of that component or composition, and are exclusive of impurities, for example, residual solvents or by-products, which may be present in commercially available sources of such components or compositions.

All percentages and ratios are calculated by weight unless otherwise indicated. All percentages and ratios are calculated based on the total composition unless otherwise indicated.

In the method of the present invention, when the first and second steps are simultaneous, the fabric may be contacted with the fabric care component and the nuclease enzyme in a wash or a rinse step of a washing process, and the fabric care component and the nuclease enzyme are provided to the water to form the aqueous liquor, in the form of a laundry cleaning or rinse-added treatment composition. In such a case, the fabric is preferably contacted with the fabric care component and the nuclease enzyme in a wash step of a laundering process.

However, more preferably steps (i) and (ii) above are sequential and in that order.

In step (i), the fabric is contacted with an aqueous liquor comprising the fabric care component. The aqueous liquor preferably comprises the rinse liquor from a fabric laundering process and is preferably the penultimate, or most preferably, the final rinse step in a fabric laundering process. The rinse step may be a hand-rinsing step, or is preferably a rinse step in an automatic washing machine. The fabric care component may be added to water in the form of a rinse-added fabric treatment composition.

In step (ii) the fabric is contacted with the nuclease enzyme in an aqueous liquor. Preferably the aqueous liquor in step (ii) comprises the wash liquor from a fabric laundering process. The laundering step may be a hand-laundering step but is preferably a washing step in an automatic washing machine. The nuclease enzyme may be added to water in the form of a laundry cleaning composition comprising the nuclease enzyme.

Preferably following step (i) and prior to step (ii) there is a drying step. Typically following the drying step, the fabrics may then be exposed to soils in the course of normal wear or use of the fabric by the user, prior to step (ii). The drying step may be open-air drying such as line-drying or drying in a machine.

Fabric Care Component

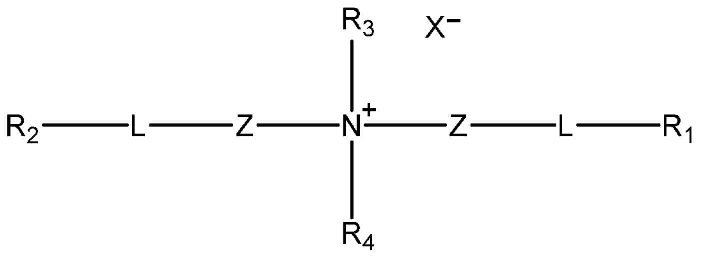
The fabric care component is preferably present in the aqueous liquor in an amount from 0.005 to 10g/l, preferably from 0.01 to 5g/l, most preferably from 0.015 to 3g/l.

The fabric care component may be selected from the group consisting of cationic softening-compounds such as quaternary ammonium compounds and cationic starches, silicone compounds, dispersible polyolefins, paraffins, waxes and mixtures thereof. Preferred fabric care components are selected from the group consisting of quaternary ammonium cationic softening compounds, silicone compounds and mixtures thereof. Preferred cationic compounds are cationic quaternary ammonium softening compounds.

Cationic Softening Compounds

Suitable cationic softening compounds are include those selected from the group comprising, diester quaternary ammonium compounds, dialkyl quaternary ammonium compounds, imidazolinium quaternary compounds, cationic starch, sucrose ester-based fabric care materials, and mixtures thereof. The ester quaternary ammonium fabric softener active may comprise a monoester, diester, and/or triester quaternary ammonium fabric softener active or an ion pair fabric softener active selected from the group consisting of:

a) materials having Formula (1) below



$$R_2-L-Z-\overset{R_3}{\underset{R_4}{N^+}}-Z-L-R_1 \quad X^-$$

(Formula 1)

wherein:

(i) R_1 and R_2 are each independently a $C_5 - C_{23}$ hydrocarbon;

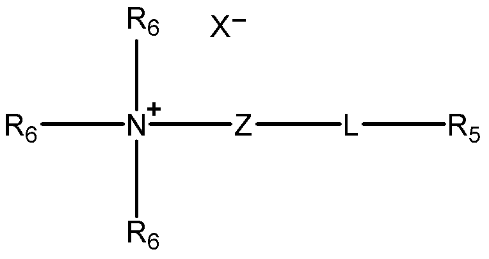
(ii) R_3 and R_4 are each independently selected from the group consisting of C_1-C_4 hydrocarbon, C_1-C_4 hydroxy substituted hydrocarbon, benzyl, $-(C_2H_4O)_yH$ where y is an integer from 1 to 10;

(iii) L is selected from the group consisting of -C(O)O-, -OC(O)-,;

(iv) Z is selected from the group consisting of $-(CH_2)_n$, $-CH_2C(CH_3)H-$ where each n is independently an integer from 1 to 4

(v) X^- is a softener-compatible anion;

b) materials having Formula (2) below



$$R_6-\overset{R_6}{\underset{R_6}{N^+}}-Z-L-R_5 \quad X^-$$

(Formula 2)

wherein

(i) R_5 is a $C_5 - C_{23}$ hydrocarbon;

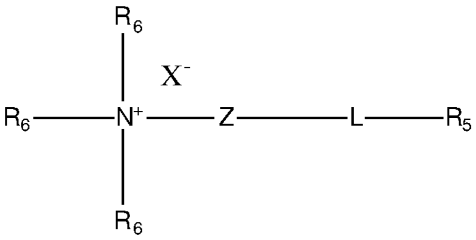
(ii) each R_6 is independently selected from the group consisting of C_1-C_4 hydrocarbon, C_1-C_4 hydroxy substituted hydrocarbon, benzyl, $-(C_2H_4O)_yH$ where y is an integer from 1 to 10;

(iii) L is selected from the group consisting of -C(O)O-, -O-(O)C-,

(iv) Z is selected from the group consisting of $-(CH_2)_n$, $-CH_2C(CH_3)H-$ where each n is independently an integer from 1 to 4;

(v) X^- is a softener-compatible anion;

c) materials having Formula (3) below



$$R_6-\overset{\overset{R_6}{|}}{\underset{\underset{R_6}{|}}{N^+}}-Z-L-R_5 \quad X^-$$

(Formula 3)

wherein

(i) R_5 is a $C_5 - C_{23}$ hydrocarbon;

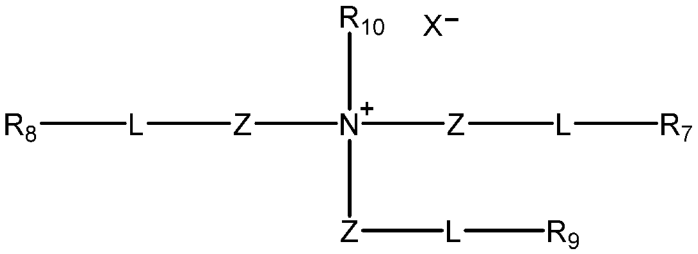
(ii) each R_6 is independently selected from the group consisting of C_1-C_4 hydrocarbon, C_1-C_4 hydroxy substituted hydrocarbon, benzyl, $-(C_2H_4O)_yH$ where y is an integer from 1 to 10;

(iii) L is selected from the group consisting of -C(O)O-, -O-(O)C-,

(iv) Z is selected from the group consisting of $-(CH_2)_n$, $-CH_2C(CH_3)H-$ where each n is independently an integer from 1 to 4;

(v) X^- is an anionic surfactant comprising a C_6-C_{24} hydrocarbon.

d) materials having Formula (4) below



$$R_8-L-Z-\overset{\overset{R_{10}}{|}}{\underset{\underset{Z-L-R_9}{|}}{N^+}}-Z-L-R_7 \quad X^-$$

(Formula 4)

wherein:

(i) R_7 , R_8 and R_9 are each independently a $C_5 - C_{23}$ hydrocarbon;

(i) R_{10} is selected from the group consisting of C_1-C_4 hydrocarbon, C_1-C_4 hydroxy substituted hydrocarbon, benzyl, $-(C_2H_4O)_yH$ where y is an integer from 1 to 10;

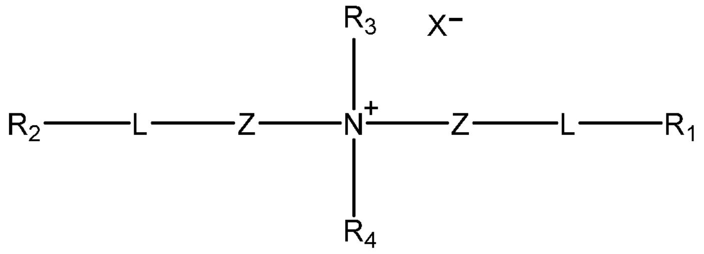
(ii) L is selected from the group consisting of -C(O)O-, -O-(O)C-;

(iii) Z is selected from the group consisting of $-(CH_2)_n$, $-CH_2C(CH_3)H-$ where each n is independently an integer from 1 to 4;

(iv) X^- is a softener-compatible anion;

In one aspect, said di-tail fabric softener active, mono-tail fabric softener active and ion pair fabric softener actives are selected from the group consisting of:

a) materials having Formula (1) below



(Formula 1)

wherein:

(i) R_1 and R_2 are each independently a $C_{11} - C_{17}$ hydrocarbon;

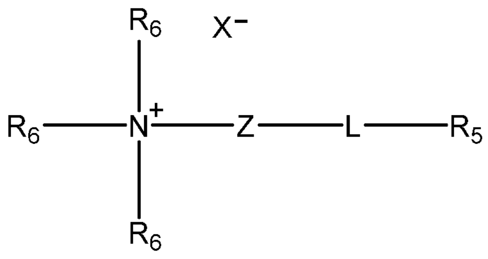
(ii) R_3 and R_4 are each independently selected from the group consisting of C_1-C_2 hydrocarbon, C_1-C_2 hydroxy substituted hydrocarbon;

(iii) Z is selected from the group consisting of $-(CH_2)_n$, $-CH_2C(CH_3)H-$ where each n is independently an integer from 1 to 2;

(iv) L is selected from the group consisting of -C(O)O-, , -O-(O)C-;

(v) X- is a softener-compatible anion, selected from the group consisting of halides, sulfonates, sulfates, and nitrates.

b) materials having Formula (2) below



(Formula 2)

wherein

(i) R_5 is a $C_{11} - C_{17}$ hydrocarbon;

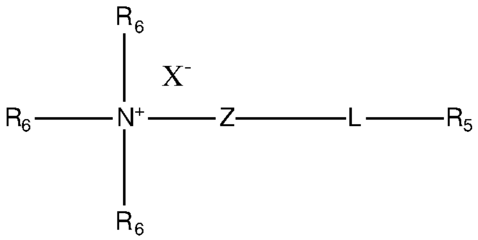
(ii) each R_6 is independently selected from the group consisting of C_1-C_2 hydrocarbon, C_1-C_2 hydroxy substituted hydrocarbon;

(iii) Z is selected from the group consisting of $-(CH_2)_n$, $-CH_2C(CH_3)H-$ where each n is independently an integer from 1 to 4;

(iv) L is selected from the group consisting of -C(O)O-, -O-(O)C-;

(v) X^- is a softener-compatible anion, selected from the group consisting of halides, sulfonates, sulfates, and nitrates;

c) materials having Formula (3) below



$$R_6-\overset{\displaystyle R_6}{\underset{\displaystyle R_6}{N^+}}-Z-L-R_5 \qquad X^-$$

(Formula 3)

wherein

(i) R_5 is a $C_{11} - C_{17}$ hydrocarbon;

(ii) each R_6 is independently selected from the group consisting of C_1-C_4 hydrocarbon, C_1-C_4 hydroxy substituted hydrocarbon, benzyl, $-(C_2H_4O)_yH$ where y is an integer from 1 to 10;

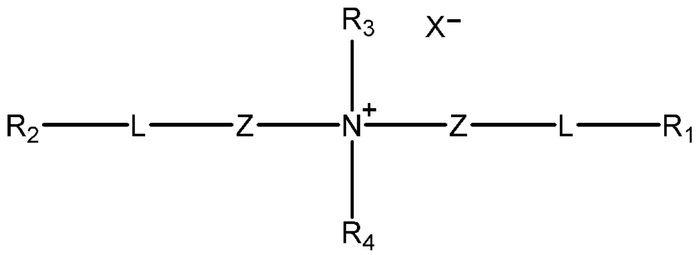
(iii) L is selected from the group consisting of -C(O)O-, -O-(O)C-,;

(iv) Z is selected from the group consisting of $-(CH_2)_n$, $-CH_2C(CH_3)H-$ where each n is independently an integer from 1 to 4;

(v) X- is an anionic surfactant comprising a C_6-C_{24} hydrocarbon.

In one aspect, said di-tail fabric softener active, mono-tail fabric softener active and ion pair fabric softener actives are selected from the group consisting of:

b) materials having Formula (1) below



$$R_2-L-Z-\overset{\displaystyle R_3}{\underset{\displaystyle R_4}{\overset{|}{\underset{|}{N^+}}}}-Z-L-R_1 \quad X^-$$

(Formula 1)

wherein:

(i) R_1 and R_2 are each independently a $C_{11} - C_{17}$ hydrocarbon;

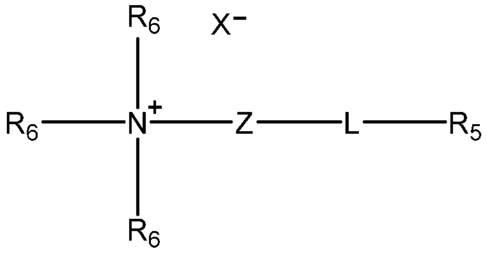
(ii) R_3 and R_4 are each independently selected from the group consisting of C_1-C_2 hydrocarbon, C_1-C_2 hydroxy substituted hydrocarbon;

(iii) Z is selected from the group consisting of $-(CH_2)_n$, $-CH_2C(CH_3)H-$ where each n is independently an integer from 1 to 2;

(iv) L is selected from the group consisting of -C(O)O-, -O-(O)C-;

(v) X^- is a softener-compatible anion, selected from the group consisting of chloride, bromide, methylsulfate, ethylsulfate, and methyl sulfonate.

b) materials having Formula (2) below



$$R_6-\overset{\displaystyle R_6}{\underset{\displaystyle R_6}{\overset{|}{\underset{|}{N^+}}}}-Z-L-R_5 \quad X^-$$

(Formula 2)

wherein

(i) R_5 is a $C_{11} - C_{17}$ hydrocarbon;

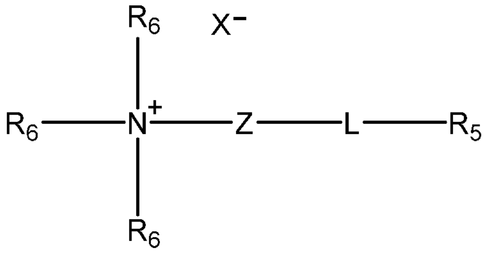
(ii) each R_6 is independently selected from the group consisting of C_1-C_2 hydrocarbon, C_1-C_2 hydroxy substituted hydrocarbon;

(iii) Z is selected from the group consisting of $-(CH_2)_n$, $-CH_2C(CH_3)H-$ where each n is independently an integer from 1 to 4;

(iv) L is selected from the group consisting of -C(O)O-, -O-(O)C-;

(v) X- is a softener-compatible anion, selected from the group consisting of chloride, bromide, methylsulfate, ethylsulfate, and methyl sulfonate or anionic surfactant comprising a C_6-C_{18} hydrocarbon

c) materials having Formula (3) below



(Formula 3)

wherein

(i) R_5 is a $C_{11} - C_{17}$ hydrocarbon;

(ii) each R_6 is independently selected from the group consisting of C_1-C_2 hydrocarbon, C_1-C_2 hydroxy substituted hydrocarbon;

(iii) Z is selected from the group consisting of $-(CH_2)_n$, $-CH_2C(CH_3)H-$ where each n is independently an integer from 1 to 4;

(iv) L is selected from the group consisting of -C(O)O-,, -O-(O)C-;

(v) X- is a softener-compatible anion, selected from the group consisting of chloride, bromide, methylsulfate, ethylsulfate, and methyl sulfonate or anionic surfactant comprising a C_6-C_{18} hydrocarbon.

In one preferred molecule according to Formula 2, X- is a C_6-C_{24} hydrocarbon that is an anionic surfactant.

Other suitable cationic softening compound fabric care component comprises a fabric softening active selected from the group consisting of N,N-di(hydrogenated tallowoyloxyethyl)-N,N-dimethylammonium chloride; N,N-di(tallowoyloxyethyl)-N,N-dimethylammonium chloride; N,N-di(hydrogenated tallowoyloxyisopropyl)-N,N-dimethylammonium chloride; N,N-di(tallowoyloxyisopropyl)-N,N-dimethylammonium chloride; N,N-di(stearoyloxyisopropyl)-N,N-dimethylammonium chloride; N,N-di(palmoyloxyisopropyl)-N,N-dimethylammonium chloride; bis-(2-hydroxypropyl)-dimethylammonium chloride stearic acid diester; partially hydrogenated bis-(2-hydroxypropyl)-dimethylammonium chloride palmitic acid diester; and mixtures thereof.

In the cationic nitrogenous salts herein, the anion A^- , which is any softener compatible anion, provides electrical neutrality. Most often, the anion used to provide electrical neutrality in these salts is from a strong acid, especially a halide, such as chloride, bromide, or iodide. However, other anions can be used, such as methylsulfate, ethylsulfate, acetate, formate, sulfate, carbonate, and the like. Chloride and methylsulfate are preferred herein as anion A. The anion can also, but less preferably, carry a double charge in which case A- represents half a group. Suitable cationic starches for use in the present compositions are commercially-available from Cerestar under the trade name C*BOND® and from National Starch and Chemical Company under the trade name CATO® 2A.

Suitable cationic softening compounds are typically part of a rinse-added fabric enhancer at a level of from about 0.1% to about 20%, alternatively from about 0.1% to about 15%, alternatively from about 0.3% to about 10%, and alternatively from about 0.5% to about 7%, by weight of the composition.

Silicones

Suitable silicones comprise Si-0 moieties and may be selected from (a) non-functionalized siloxane polymers, (b) functionalized siloxane polymers, and combinations thereof. The molecular weight of the organosilicone is usually indicated by the reference to the viscosity of the material. The organosilicones may comprise a viscosity of from 10 to 2,000,000 centistokes at 25°C, or even from 10 to 800,000 centistokes at 25°C.

Suitable functionalised silicones can be selected from the group consisting of: organosilicones, silicone-based quaternary ammonium compounds, silicone polyethers, aminosilicones, cyclic silicones, silicone urethanes, polydialkylsilicone, polydimethyl silicones (polydimethyl siloxane or "PDMS"), or derivatives thereof, aminofunctional silicones, amino-polyether silicones, alkyloxylated silicones, cationic silicones, ethoxylated silicons, propoxylated silicones, ethoxylated/propoxylated silicones, quaternary silicones, and combinations thereof

Amino-silicones may be preferred. Suitable organosilicones may be linear, branched or cross-linked. The organosilicones may comprise of silicone resins. Silicone resins are highly cross-linked polymeric siloxane systems. The cross-linking is introduced through the incorporation of trifunctional and tetrafunctional silanes with monofunctional or difunctional, or both, silanes during manufacture of the silicone resin.

Other modified silicones or silicone copolymers are also useful herein. Examples of these include silicone-based quaternary ammonium compounds (Kennan quats) disclosed in U.S. Patent Nos. 6,607,717 and 6,482,969; end-terminal quaternary siloxanes; silicone aminopolyalkyleneoxide block copolymers disclosed in U.S. Patent Nos. 5,807,956 and 5,981,681; hydrophilic silicone emulsions disclosed in U.S. Patent No. 6,207,782; and polymers made up of one or more crosslinked rake or comb silicone copolymer segments disclosed in US Patent No. 7,465,439. Additional modified silicones or silicone copolymers useful herein are described in US Patent Application Nos. 2007/0286837A1 and 2005/0048549A1.

Especially when the fabric care component comprises silicone-based quaternary ammonium compounds, preferably the aqueous liquor additionally comprises silicone polymers, for example as described in US Patent Nos 7,041,767 and 7,217,777 and US Application number 2007/0041929A1.

Suitable silicones include organosilicones. The organosilicone may be polydimethylsiloxane, dimethicone, dimethiconol, dimethicone crosspolymer, phenyl trimethicone, alkyl dimethicone, lauryl dimethicone, stearyl dimethicone and phenyl dimethicone. Examples include those available under the names DC 200 Fluid, DC 1664, DC 349, DC 346G available from Dow Corning® Corporation, Midland, MI, and those available under the trade names SF1202, SF1204, SF96, and Viscasil® available from Momentive Silicones, Waterford, NY. The organosilicone may be a cyclic silicone. The cyclic silicone may comprise a cyclomethicone of the formula [(CH3)2SiO]n where n is an integer that may range from about 3 to about 7, or from about 5 to about 6. The organosilicone may be a functionalized siloxane polymer. Functionalized siloxane polymers comprise one or more functional moieties, preferably selected from the group consisting of amino, amido, alkoxy, hydroxy, polyether, carboxy, hydride, mercapto, sulfate phosphate, and/or quaternary ammonium moieties. These moieties may be attached directly to the siloxane backbone through a bivalent alkylene radical, (i.e., "pendant") or may be part of the backbone. Suitable functionalized siloxane polymers include materials selected from the group consisting of aminosilicones, amidosilicones, silicone polyethers, silicone-urethane polymers, quaternary ABn silicones, amino ABn silicones, and combinations thereof.

Suitable functionalised silicones include silicone polyether, also referred to as "dimethicone copolyol." In general, silicone polyethers comprise a polydimethylsiloxane backbone with one or more polyoxyalkylene chains. The polyoxyalkylene moieties may be incorporated in the polymer as pendent chains or as terminal blocks. Such silicones are described in USPA 2005/0098759, and USPNs 4,818,421 and 3,299,112. Exemplary commercially available silicone polyethers include DC 190, DC 193, FF400, all available from Dow Corning® Corporation, and various Silwet® surfactants available from Momentive Silicones.

The functionalized silicone may be an aminosilicone. Suitable aminosilicones are described in USPNs 7,335,630 B2, 4,911,852, and USPA 2005/0170994A1.

Suitable levels of silicone in a treatment composition may comprise from about 0.1% to about 70%, alternatively from about 0.3% to about 40%, alternatively from about 0.5% to about 30%, alternatively from about 1% to about 20% by weight of the composition.

Dispersible Polyolefins

Suitable polyolefins can be in the form of waxes, emulsions, dispersions or suspensions. Suitable examples may be selected from a polyethylene, polypropylene, or a combination thereof. The polyolefin may be at least partially modified to contain various functional groups, such as carboxyl, alkylamide, sulfonic acid or amide groups. The polyolefin may be at least partially carboxyl modified or, in other words, oxidized.

For ease of formulation, the dispersible polyolefin may be introduced as a suspension or an emulsion of polyolefin dispersed by use of an emulsifying agent. The polyolefin suspension or emulsion may comprise from about 1% to about 60%, alternatively from about 10% to about 55%, alternatively from about 20% to about 50% by weight of polyolefin. The polyolefin may have a wax dropping point (see ASTM D3954- 94, volume 15.04 --- "Standard Test Method for Dropping Point of Waxes") from about 20° to about 170oC, alternatively from about 50° to about 140oC. Suitable polyethylene waxes are available commercially from suppliers including but not limited to Honeywell (A-C polyethylene), Clariant (Velustrol® emulsion), and BASF (LUWAX®).

When an emulsion is employed with the dispersible polyolefin, the emulsifier may be any suitable emulsification agent. Non-limiting examples include an anionic, cationic, nonionic surfactant, or a combination thereof. However, almost any suitable surfactant or suspending agent may be employed as the emulsification agent. The dispersible polyolefin is dispersed by use of an emulsification agent in a ratio to polyolefin wax of about 1:100 to about 1:2, alternatively from about 1:50 to about 1:5, respectively.

The inventors of the present invention have found that surprisingly the deposition of the nuclease enzyme is increased because the fabric care component provides increased hydrophobicity to the fabric surface, leading to increased efficacy.

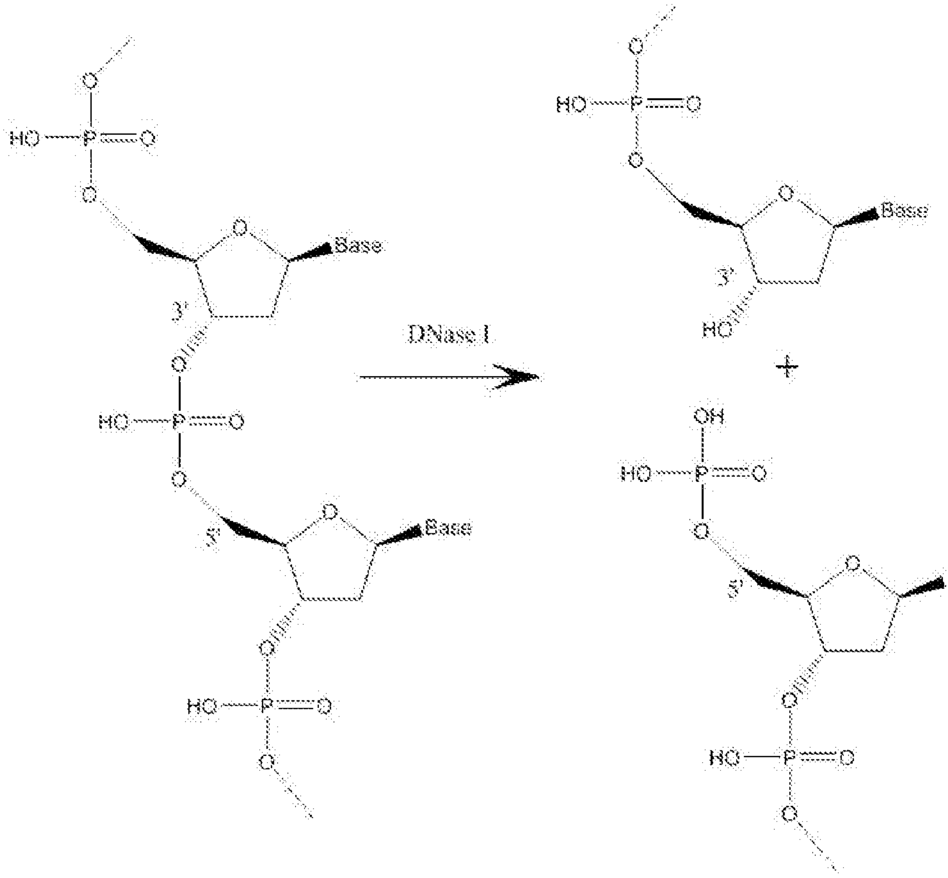
In step (i) the fabric care component may be added to the aqueous liquor via a rinse-added fabric treatment composition. Typically these comprise in addition the fabric care component, optional additional rinse-added ingredients, such as such as perfumes, dyes, polymers.

Nuclease Enzyme

The nuclease enzyme is an enzyme capable of cleaving the phosphodiester bonds between the nucleotide sub-units of nucleic acids. The nuclease enzyme herein is preferably a deoxyribonuclease or ribonuclease enzyme or a functional fragment thereof. By functional fragment or part is meant the portion of the nuclease enzyme that catalyzes the cleavage of phosphodiester linkages in the DNA backbone and so is a region of said nuclease protein that retains catalytic activity. Thus it includes truncated, but functional versions, of the enzyme and/or variants and/or derivatives and/or homologues whose functionality is maintained.

Preferably the nuclease enzyme is a deoxyribonuclease, preferably selected from any of the classes E.C. 3.1.21.x, where x=1, 2, 3, 4, 5, 6, 7, 8 or 9, E.C. 3.1.22.y where y=1, 2, 4 or 5, E.C. 3.1.30.z where z= 1 or 2, E.C. 3.1.31.1 and mixtures thereof.

Nucleases in class E.C. 3.1.21.x cleave at the 3' hydroxyl to liberate 5' phosphomonoesters as follows:



Nuclease enzymes from class E.C. 3.1.21.x and especially where x=1 are particularly preferred.

Nucleases in class E.C. 3.1.22.y cleave at the 5' hydroxyl to liberate 3' phosphomonoesters. Enzymes in class E.C. 3.1.30.z may be preferred as they act on both DNA and RNA and liberate 5'-phosphomonoesters. Suitable examples from class E.C. 3.1.31.2 are described in US2012/0135498A, such as SEQ ID NO:3 therein. Such enzymes are commercially available as DENARASE® enzyme from c-LECTA.

Nuclease enzymes from class E.C. 3.1.31.1 produce 3'phosphomonoesters.

Preferably, the nuclease enzyme comprises a microbial enzyme. The nuclease enzyme may be fungal or bacterial in origin. Bacterial nucleases may be most preferred. Fungal nucleases may be most preferred.

The microbial nuclease is obtainable from *Bacillus*, such as a *Bacillus licheniformis* or *Bacillus subtilis* bacterial nucleases. A preferred nuclease is obtainable from *Bacillus licheniformis,* preferably from strain EI-34-6. A preferred deoxyribonuclease is a variant of *Bacillus licheniformis*, from strain EI-34-6 nucB deoxyribonuclease defined in SEQ ID NO:1

herein, or variant thereof, for example having at least 70% or 75% or 80% or 85% or 90% or 95%, 96%, 97%, 98%, 99% or 100% identical thereto.

Other suitable nucleases are defined in SEQ ID NO:2 herein, or variant thereof, for example having at least 70% or 75% or 80% or 85% or 90% or 95%, 96%, 97%, 98%, 99% or 100% identical thereto. Other suitable nucleases are defined in SEQ ID NO:3 herein, or variant thereof, for example having at least 70% or 75% or 80% or 85% or 90% or 95%, 96%, 97%, 98%, 99% or 100% identical thereto. Other suitable nucleases are defined in SEQ ID NO:2 herein, or variant thereof, for example having at least 70% or 75% or 80% or 85% or 90% or 95%, 96%, 97%, 98%, 99% or 100% identical thereto. Other suitable nucleases are defined in SEQ ID NO:3 herein, or variant thereof, for example having at least 70% or 75% or 80% or 85% or 90% or 95%, 96%, 97%, 98%, 99% or 100% identical thereto.

A fungal nuclease is obtainable from *Aspergillus,* for example *Aspergillus oryzae.* A preferred nuclease is obtainable from *Aspergillus oryzae* defined in SEQ ID NO: 5 herein, or variant thereof, for example having at least 60% or 70% or75% or 80% or 85% or 90% or 95%, 96%, 97%, 98%, 99% or 100% identical thereto.

Another suitable fungal nuclease is obtainable from *Trichoderma,* for example *Trichoderma harzianum.* A preferred nuclease is obtainable from *Trichoderma harzianum* defined in SEQ ID NO: 6 herein, or variant thereof, for example having at least 60% or 70% or75% or 80% or 85% or 90% or 95%, 96%, 97%, 98%, 99% or 100% identical thereto.

Other fungal nucleases include those encoded by the DNA sequences of *Aspergillus oryzae* RIB40, *Aspergillus oryzae* 3.042, *Aspergillus flavus* NRRL3357, *Aspergillus parasiticus* SU-1, *Aspergillus nomius* NRRL13137, *Trichoderma reesei* QM6a, *Trichoderma virens* Gv29-8, *Oidiodendron maius* Zn, *Metarhizium guizhouense* ARSEF 977, *Metarhizium majus* ARSEF 297, *Metarhizium robertsii* ARSEF 23, *Metarhizium acridum* CQMa 102, *Metarhizium brunneum* ARSEF 3297, *Metarhizium anisopliae*, *Colletotrichum fioriniae* PJ7, *Colletotrichum sublineola*, *Trichoderma atroviride* IMI 206040, *Tolypocladium ophioglossoides* CBS 100239, *Beauveria bassiana* ARSEF 2860, *Colletotrichum higginsianum*, *Hirsutella minnesotensis* 3608, *Scedosporium apiospermum*, *Phaeomoniella chlamydospora*, *Fusarium verticillioides* 7600, *Fusarium oxysporum* f. sp. cubense race 4, *Colletotrichum graminicola* M1.001, *Fusarium oxysporum* FOSC 3-a, *Fusarium avenaceum*, *Fusarium langsethiae*, *Grosmannia clavigera* kw1407, *Claviceps purpurea* 20.1, *Verticillium longisporum*, *Fusarium oxysporum* f. sp. cubense race 1, *Magnaporthe oryzae* 70-15, *Beauveria bassiana* D1-5, *Fusarium pseudograminearum* CS3096, *Neonectria ditissima*, *Magnaporthiopsis poae* ATCC 64411, *Cordyceps militaris* CM01, *Marssonina brunnea* f. sp. 'multigermtubi' MB_m1, *Diaporthe ampelina*, *Metarhizium* *album* ARSEF 1941, *Colletotrichum gloeosporioides* Nara gc5, *Madurella mycetomatis*, *Metarhizium brunneum* ARSEF 3297, *Verticillium alfalfae* VaMs.102, *Gaeumannomyces graminis* var. tritici R3-111a-1, *Nectria haematococca* mpVI 77-13-4, *Verticillium longisporum*, *Verticillium dahliae* VdLs.17, *Torrubiella hemipterigena*, *Verticillium longisporum*, *Verticillium dahliae* VdLs.17, *Botrytis cinerea* B05.10, *Chaetomium globosum* CBS 148.51, *Metarhizium anisopliae*, *Stemphylium lycopersici*, *Sclerotinia borealis* F-4157, *Metarhizium robertsii* ARSEF 23, *Myceliophthora thermophila* ATCC 42464, *Phaeosphaeria nodorum* SN15, *Phialophora attae*, *Ustilaginoidea virens*, *Diplodia seriata, Ophiostoma piceae* UAMH 11346, *Pseudogymnoascus pannorum* VKM F-4515 (FW-2607), *Bipolaris oryzae* ATCC 44560, *Metarhizium guizhouense* ARSEF 977, *Chaetomium thermophilum* var. thermophilum DSM 1495, *Pestalotiopsis fici* W106-1, *Bipolaris zeicola* 26-R-13, *Setosphaeria turcica* Et28A, *Arthroderma otae* CBS 113480 and *Pyrenophora tritici-repentis* Pt-1C-BFP.

Preferably the nuclease is an isolated nuclease.

Preferably the nuclease enzyme is present in the aqueous liquor in an amount of from 0.01ppm to 1000 ppm of the nuclease enzyme, or from 0.05 or from 0.1ppm to 750 or 500ppm.

The nucleases may also give rise to biofilm-disrupting effects.

In a preferred composition, the composition additionally comprises a β-N-acetylglucosaminidase enzyme from E.C. 3.2.1.52, preferably an enzyme having at least 70%, or at least 75% or at least 80% or at least 85% or at least 90% or at least 95% or at least 96% or at least 97% or at least 98% or at least 99% or at least or 100% identity to SEQ ID NO:4.

Where the aqueous wash liquor comprises cleaning wash liquor, preferably it comprises anionic and/or non-ionic surfactant in addition to the nuclease enzyme, preferably the wash liquor comprising from 0.05 to 4g/l of a surfactant. In a laundering or washing step (i) and/or step (ii) it may be preferred for the ratio of anionic and/or nonionic surfactant to fabric on a weight to weight basis to be from 1:150 to 1:500 in step (i) and/or step (iii).

Cleaning and/or Treatment Adjunct Materials

When the aqueous liquor in step (i) and step (ii), respectively are provided by the addition of a cleaning and/or treatment compositions to water, in addition to the nuclease enzyme and fabric care component, the cleaning and/or treatment composition will comprise optional cleaning and/or treatment adjunct materials. Suitable adjuncts may be, for example to assist or enhance cleaning performance, for treatment of the substrate to be cleaned, for example by softening or freshening, or to modify the aesthetics of the detergent composition as is the case with perfumes, colorants, non-fabric-shading dyes or the like. Suitable adjunct materials include, but are not limited to, surfactants, builders, chelating agents, dispersants, enzymes, and enzyme stabilizers, catalytic materials, bleach activators, hydrogen peroxide, sources of hydrogen peroxide, preformed peracids, polymeric dispersing agents, clay soil removal/anti-redeposition agents, additional brighteners, suds suppressors, dyes, hueing dyes, perfumes, perfume delivery systems, structure elasticizing agents, fabric softeners, carriers, hydrotropes, processing aids, solvents, additional dyes and/or pigments, some of which are discussed in more detail below. In addition to the disclosure below, suitable examples of such other adjuncts and levels of use are found in U.S. Patent Nos. 5,576,282, 6,306,812 B1 and 6,326,348 B1 that are incorporated by reference.

The nuclease enzyme will preferably be present in a cleaning and/or treatment composition in amounts of 0.00001% to about 3% by weight, from about 0.0001% to about 2% by weight or even from about 0.001% to about 1% by weight enzyme protein by weight of the composition.

Preferably the composition will additionally comprise a β-N-acetylglucosaminidase enzyme from E.C. 3.2.1.52, preferably an enzyme having at least 70%, or at least 75% or at least 80% or at least 85% or at least 90% or at least 95% or at least 96% or at least 97% or at least 98% or at least 99% or at least or 100% identity to SEQ ID NO: 4. When present, the β-N-acetylglucosaminidase enzyme will typically be present in an amount from 0.00001% to about 2%, from about 0.0001% to about 1% or even from about 0.001% to about 0.5% enzyme protein by weight of the composition.

In step (ii) the nuclease may be added to water to form the aqueous liquor via a cleaning composition which typically comprises from 1 to 70 wt%, or from 2 to 50 wt% or from 5 to 40 wt%, based on the total weight of the cleaning composition, of a surfactant. The concentration of the surfactant in the wash liquor is preferably from 0.05 to 5g/l, or from 0.1 to 4g/l.

The detersive surfactant may be an anionic, cationic, non-ionic, zwitterionic, amphoteric surfactant or a combination thereof. The surfactant composition may comprise one surfactant or typically mixtures of more than one surfactant, combinations of anionic and nonionic surfactant are preferred.

Preferred anionic detersive surfactants are alkyl benzene sulfonates, alkoxylated anionic surfactant, or a combination thereof. Suitable anionic detersive surfactants include sulphate and sulphonate detersive surfactants.

Particularly preferred alkyl benzene sulphonates are linear alkylbenzene sulphonates, particularly those having a carbon chain length of C8-15, or C_{10-13} alkyl benzene sulphonate. Suitable alkyl benzene sulphonate (LAS) is obtainable, or even obtained, by sulphonating commercially available linear alkyl benzene (LAB); suitable LAB includes low 2-phenyl LAB, such as those supplied by Sasol under the tradename Isochem® or those supplied by Petresa under the tradename Petrelab®, other suitable LAB include high 2-phenyl LAB, such as those supplied by Sasol under the tradename Hyblene®. Another suitable anionic detersive surfactant is alkyl benzene sulphonate that is obtained by DETAL catalyzed process, preferably having 8 to 15 carbon atoms. Other synthesis routes, such as HF, may also be suitable.

Suitable sulphate detersive surfactants include alkyl sulphate, such as C_{8-18} alkyl sulphate, or predominantly C_{12} alkyl sulphate. The alkyl sulphate may be derived from natural sources, such as coco and/or tallow. Alternatively, the alkyl sulphate may be derived from synthetic sources such as C_{12-15} alkyl sulphate.

It may be preferred for the surfactant composition to comprise in addition an alkyl alkoxylated sulphate, such as alkyl ethoxylated sulphate, or a C_{8-18} alkyl alkoxylated sulphate, or a C_{8-18} alkyl ethoxylated sulphate. Preferably the alkyl chain length may be from 12 to 16 carbon atoms. The alkyl alkoxylated sulphate may have an average degree of alkoxylation of from 0.5 to 20, or from 0.5 to 10, or from 0.5 to 7, or from 0.5 to 5 or from 0.5 to 3. Examples include predominantly C12 sodium lauryl ether sulphate ethoxylated with an average of 3 moles of ethylene oxide per mole.

The alkyl sulphate, alkyl alkoxylated sulphate and alkyl benzene sulphonates may be linear or branched, substituted or un-substituted.

The anionic detersive surfactant may be a mid-chain branched anionic detersive surfactant, such as a mid-chain branched alkyl sulphate and/or a mid-chain branched alkyl benzene sulphonate. The mid-chain branches are typically C_{1-4} alkyl groups, such as methyl and/or ethyl groups.

Another suitable anionic detersive surfactant is alkyl ethoxy carboxylate.

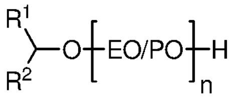
The anionic surfactants are typically present in their salt form, typically being complexed with a suitable cation. Suitable counter-ions include Na^+ and K^+, substituted ammonium such as C_1-C_6 alkanolammnonium such as mono-ethanolamine (MEA) tri-ethanolamine (TEA), di-ethanolamine (DEA), and any mixture thereof.

Preferably the surfactant composition comprises a non-ionic detersive surfactant in addition to the anionic surfactant. Preferred nonionic surfactants are primary and secondary alcohol alkoxylates, especially ethoxylates. Suitable non-ionic detersive surfactants include alkyl alkoxylated alcohols, such as C_{8-18} alkyl alkoxylated alcohol, or a C_{8-18} alkyl ethoxylated alcohol. The alkyl alkoxylated alcohol may have an average degree of alkoxylation of from 0.5 to 50, or from 1 to 30, or from 1 to 20, or from 1 to 10. The alkyl alkoxylated alcohol may be a C_{8-18} alkyl ethoxylated alcohol, typically having an average degree of ethoxylation of from 1 to

10, or from 1 to 7, or from 1 to 5, or from 3 to 7. The alkyl alkoxylated alcohol can be linear or branched, and substituted or un-substituted.

Suitable examples of nonionic surfactants include those selected from the group consisting of: C_8-C_{18} alkyl ethoxylates, such as, NEODOL® non-ionic surfactants from Shell; C_6-C_{12} alkyl phenol alkoxylates wherein optionally the alkoxylate units are ethyleneoxy units, propyleneoxy units or a mixture thereof; C_{12}-C_{18} alcohol and C_6-C_{12} alkyl phenol condensates with ethylene oxide/propylene oxide block polymers such as Pluronic® from BASF; C_{14}-C_{22} mid-chain branched alcohols; C_{14}-C_{22} mid-chain branched alkyl alkoxylates, typically having an average degree of alkoxylation of from 1 to 30; alkylpolysaccharides, such as alkylpolyglycosides; polyhydroxy fatty acid amides; ether capped poly(oxyalkylated) alcohol surfactants; and mixtures thereof. Suitable non-ionic detersive surfactants are also alkyl polyglucoside and/or an alkyl alkoxylated alcohol.

Suitable nonionic detersive surfactants include secondary alcohol-based detersive surfactants having the formula:



wherein R^1 = linear or branched, substituted or unsubstituted, saturated or unsaturated $C_{2\text{-}8}$ alkyl; wherein R^2 = linear or branched, substituted or unsubstituted, saturated or unsaturated $C_{2\text{-}8}$ alkyl, wherein the total number of carbon atoms present in R^1 + R^2 moieties is in the range of from 7 to 13; wherein EO/PO are alkoxy moieties selected from ethoxy, propoxy, or mixtures thereof, optionally the EO/PO alkoxyl moieties are in random or block configuration; wherein n is the average degree of alkoxylation and is in the range of from 4 to 10.

Other suitable non-ionic detersive surfactants include EO/PO block co-polymer surfactants, such as the Plurafac® series of surfactants available from BASF, and sugar-derived surfactants such as alkyl N-methyl glucose amide.

The ratio of anionic surfactant to nonionic surfactant may be from 2:1 to 1:2, or even from 1:1 to 1:3 or from greater than 1:1 to 1:2.

The composition may also comprise an amine oxide preferably in amounts up to 10 wt% of the surfactant composition. Suitable amine oxides are described in WO2014/114570, a particularly preferred amine oxide comprising lauryl dimethylamine oxide. The composition may also comprise a zwitterionic surfactant. A preferred zwitterionic surfactant is a betaine surfactant, for example a carbobetaine, such as Empigen® from Huntsman. Where amine oxide and/or betaine surfactant is present, the weight ratio of anionic and/or nonionic surfactant to amine oxide and/or betaine is typically from 10:1 to 20:1.

The fabric may be contacted with the respective liquor in any of steps (i) and (ii) at a temperature of 60°C or less, or even 40°C or less. In particular, the fabric may be contacted with the respective wash liquors of steps (i) and/or (ii) at a temperature of between 5°C and 50°C, preferably between 10°C and 30°C. The fabric may be contacted at these temperatures in the wash cycle of a domestic washing machine.

The fabric may be contacted with the nuclease in step (ii) in a wash cycle of an automatic washing machine and the length of the wash cycle may be at least 3 minutes, or even at least 6 mins, or even at least 10 mins, but no more than 40 minutes, or even no more than 30 minutes, or even no more than 20 minutes.

Particularly preferred additional adjunct materials may be further enzymes.

Enzymes. Preferably the composition comprises one or more additional enzymes. Preferred enzymes provide cleaning performance and/or fabric care benefits. Examples of suitable enzymes include, but are not limited to, hemicellulases, peroxidases, proteases, cellulases, xylanases, lipases, phospholipases, esterases, cutinases, pectinases, mannanases, pectate lyases, keratinases, reductases, oxidases, phenoloxidases, lipoxygenases, ligninases, pullulanases, tannases, pentosanases, malanases, ß-glucanases, arabinosidases, hyaluronidase, chondroitinase, laccase, and amylases, or mixtures thereof. A preferred combination of additional enzymes comprises a protease and a lipase, preferably in conjunction with amylase. When present in the composition, the aforementioned additional enzymes may each be present at levels from about 0.00001% to about 2%, from about 0.0001% to about 1% or even from about 0.001% to about 0.5% enzyme protein by weight of the composition.

Proteases. Preferably the composition comprises one or more proteases. Suitable proteases include metalloproteases and serine proteases, including neutral or alkaline microbial serine proteases, such as subtilisins (EC 3.4.21.62). Suitable proteases include those of animal, vegetable or microbial origin. In one aspect, such suitable protease may be of microbial origin. The suitable proteases include chemically or genetically modified mutants of the aforementioned suitable proteases. In one aspect, the suitable protease may be a serine protease, such as an alkaline microbial protease or/and a trypsin-type protease. Examples of suitable neutral or alkaline proteases include:

(a) subtilisins (EC 3.4.21.62), including those derived from Bacillus, such as Bacillus lentus, B. alkalophilus, B. subtilis, B. amyloliquefaciens, Bacillus pumilus and Bacillus gibsonii described in US 6,312,936 B1, US 5,679,630, US 4,760,025, US7,262,042 and WO09/021867.

(b) trypsin-type or chymotrypsin-type proteases, such as trypsin (e.g., of porcine or bovine origin), including the Fusarium protease described in WO 89/06270 and the chymotrypsin proteases derived from Cellumonas described in WO 05/052161 and WO 05/052146.

(c) metalloproteases, including those derived from Bacillus amyloliquefaciens described in WO 07/044993A2.

Preferred proteases include those derived from Bacillus gibsonii or Bacillus Lentus.

Suitable commercially available protease enzymes include those sold under the trade names Alcalase®, Savinase®, Primase®, Durazym®, Polarzyme®, Kannase®, Liquanase®, Liquanase Ultra®, Savinase Ultra®, Ovozyme®, Neutrase®, Everlase® and Esperase® by Novozymes A/S (Denmark), those sold under the tradename Maxatase®, Maxacal®, Maxapem®, Properase®, Purafect®, Purafect Prime®, Purafect Ox®, FN3® , FN4®, Excellase® and Purafect OXP® by Genencor International, those sold under the tradename Opticlean® and Optimase® by Solvay Enzymes, those available from Henkel/ Kemira, namely BLAP (sequence shown in Figure 29 of US 5,352,604 with the following mutations S99D + S101 R + S103A + V104I + G159S, hereinafter referred to as BLAP), BLAP R (BLAP with S3T + V4I + V199M + V205I + L217D), BLAP X (BLAP with S3T + V4I + V205I) and BLAP F49 (BLAP with S3T + V4I + A194P + V199M + V205I + L217D) - all from Henkel/Kemira; and KAP (Bacillus alkalophilus subtilisin with mutations A230V + S256G + S259N) from Kao, or as disclosed in WO2009/149144, WO2009/149145, WO2010/56653, WO2010/56640, WO2011/072117, US2011/0237487, WO2011/140316, WO2012/151480, EP2510092, EP2566960 OR EP2705145.

Amylases. Preferably the composition may comprise an amylase. Suitable alpha-amylases include those of bacterial or fungal origin. Chemically or genetically modified mutants (variants) are included. A preferred alkaline alpha-amylase is derived from a strain of Bacillus, such as Bacillus licheniformis, Bacillus amyloliquefaciens, Bacillus stearothermophilus, Bacillus subtilis, or other Bacillus sp., such as Bacillus sp. NCIB 12289, NCIB 12512, NCIB 12513, DSM 9375 (USP 7,153,818) DSM 12368, DSMZ no. 12649, KSM AP1378 (WO 97/00324), KSM K36 or KSM K38 (EP 1,022,334). Preferred amylases include:

(a) the variants described in WO 94/02597, WO 94/18314, WO96/23874 and WO 97/43424, especially the variants with substitutions in one or more of the following positions versus the enzyme listed as SEQ ID No. 2 in WO 96/23874: 15, 23, 105, 106, 124, 128, 133, 154, 156, 181 , 188, 190, 197, 202, 208, 209, 243, 264, 304, 305, 391, 408, and 444.

(b) the variants described in USP 5,856,164 and WO99/23211, WO 96/23873, WO00/60060 and WO 06/002643, especially the variants with one or more substitutions in the following positions versus the AA560 enzyme listed as SEQ ID No. 12 in WO 06/002643:

26, 30, 33, 82, 37, 106, 118, 128, 133, 149, 150, 160, 178, 182, 186, 193, 203, 214, 231, 256, 257, 258, 269, 270, 272, 283, 295, 296, 298, 299, 303, 304, 305, 311, 314, 315, 318, 319, 339, 345, 361, 378, 383, 419, 421, 437, 441, 444, 445, 446, 447, 450, 461, 471, 482, 484, preferably that also contain the deletions of D183* and G184*.

(c) variants exhibiting at least 90% identity with SEQ ID No. 4 in WO06/002643, the wild-type enzyme from Bacillus SP722, especially variants with deletions in the 183 and 184 positions and variants described in WO 00/60060, which is incorporated herein by reference.

(d) variants exhibiting at least 95% identity with the wild-type enzyme from Bacillus sp.707 (SEQ ID NO:7 in US 6,093, 562), especially those comprising one or more of the following mutations M202, M208, S255, R172, and/or M261. Preferably said amylase comprises one or more of M202L, M202V, M202S, M202T, M202I, M202Q, M202W, S255N and/or R172Q. Particularly preferred are those comprising the M202L or M202T mutations.

(e) variants described in WO 09/149130, preferably those exhibiting at least 90% identity with SEQ ID NO: 1 or SEQ ID NO:2 in WO 09/149130, the wild-type enzyme from Geobacillus Stearophermophilus or a truncated version thereof;

(f) variants as described in EP2540825 and EP2357220, EP2534233; (g) variants as described in WO2009100102 and WO2010115028.

Suitable commercially available alpha-amylases include DURAMYL®, LIQUEZYME®, TERMAMYL®, TERMAMYL ULTRA®, NATALASE®, SUPRAMYL®, STAINZYME®, STAINZYME PLUS®, FUNGAMYL® and BAN® (Novozymes A/S, Bagsvaerd, Denmark), KEMZYM® AT 9000 Biozym Biotech Trading GmbH Wehlistrasse 27b A-1200 Wien Austria, RAPIDASE® , PURASTAR®, ENZYSIZE®, OPTISIZE HT PLUS®, POWERASE® and PURASTAR OXAM® (Genencor International Inc., Palo Alto, California) and KAM® (Kao, 14-10 Nihonbashi Kayabacho, 1-chome, Chuo-ku Tokyo 103-8210, Japan). In one aspect, suitable amylases include NATALASE®, STAINZYME® and STAINZYME PLUS® and mixtures thereof.

Lipases. Preferably the composition comprises one or more lipases, including “first cycle lipases” such as those described in U.S. Patent 6,939,702 B1 and US PA 2009/0217464. Preferred lipases are first-wash lipases. In one embodiment of the invention the composition comprises a first wash lipase. First wash lipases includes a lipase which is a polypeptide having an amino acid sequence which: (a) has at least 90% identity with the wild-type lipase derived from Humicola lanuginosa strain DSM 4109; (b) compared to said wild-type lipase, comprises a substitution of an electrically neutral or negatively charged amino acid at the surface of the three-dimensional structure within 15A of E1 or Q249 with a positively charged amino acid; and (c) comprises a peptide addition at the C-terminal; and/or (d) comprises a peptide addition at the N-terminal and/or (e) meets the following limitations: i) comprises a negative amino acid in position E210 of said wild-type lipase; ii) comprises a negatively charged amino acid in the region corresponding to positions 90-101 of said wild-type lipase; and iii) comprises a neutral or negative amino acid at a position corresponding to N94 or said wild-type lipase and/or has a negative or neutral net electric charge in the region corresponding to positions 90-101 of said wild-type lipase. Preferred are variants of the wild-type lipase from Thermomyces lanuginosus comprising one or more of the T231R and N233R mutations. The wild-type sequence is the 269 amino acids (amino acids 23 – 291) of the Swissprot accession number Swiss-Prot O59952 (derived from Thermomyces lanuginosus (Humicola lanuginosa)). Preferred lipases would include those sold under the tradenames Lipex® and Lipolex® and Lipoclean®. Other suitable lipases include those described in European Patent Application No. 12001034.3 or EP2623586.

Endoglucanases. Other preferred enzymes include microbial-derived endoglucanases exhibiting endo-beta-1,4-glucanase activity (E.C. 3.2.1.4), including a bacterial polypeptide endogenous to a member of the genus Bacillus which has a sequence of at least 90%, 94%, 97% and even 99% identity to the amino acid sequence SEQ ID NO:2 in US7,141,403B2) and mixtures thereof. Suitable endoglucanases are sold under the tradenames Celluclean® and Whitezyme® (Novozymes A/S, Bagsvaerd, Denmark).

Pectate Lyases. Other preferred enzymes include pectate lyases sold under the tradenames Pectawash®, Pectaway®, Xpect® and mannanases sold under the tradenames Mannaway® (all from Novozymes A/S, Bagsvaerd, Denmark), and Purabrite® (Genencor International Inc., Palo Alto, California).

Antimicrobials. It may be preferred for the compositions to comprise in addition, one or mixtures of more than one compounds which may give rise to anti-microbial effects. These may be standard ingredients of the treatment compositions that are added for cleaning or malodor benefits such as bleaching agents, but have some anti-microbial effect or they may be added specifically to provide anti-microbial effect. Suitable examples may include but are not limited to aldehydes (formaldehyde, glutaraldehyde, ortho-phtalaldehyde), sulphur dioxide, sulphites, bisulphites, vanillic acid esters), chlorine and oxygen based oxidizing agents (sodium and calcium hypochlorite or hypobromite, chloramine and chloramine-T, chlorine dioxide, hydrogen peroxide, iodine, ozone, peracetic acid, performic acid, potassium permanganate, potassium peroxymonosulfate), phenolics (phenol, o-phenylphenol, chloroxylenol, hexachlorophene, thymol, amylmetacresol, 2,4-dichlorobenzyl alcohol, policresylen, fentichlor, 4-allylcatechol, p-hydroxybenzoic acid esters including benzylparaben, butylparaben, ethylparaben, methtlparaben and propylparaben, butylated hydroxyanisole, butylated hydroxytoluene, capaicin, carvacrol, creosol, eugenol, guaiacol), halogenated (hydroxy)diphenylethers (diclosan, triclosan, hexachlorophene and bromochlorophene, 4-hexylresorcinol, 8-hydroxyquinoline and salts thereof), quaternary ammonium compounds (benzalkonium chloride derivatives, benzethonium chloride derivatives, cetrimonium chloride/bromide, cetylpyridinium, cetrimide, benzoxonium chloride, didecyldimethyl ammonium chloride), acridine derivatives (ethacridine lactate, 9-aminoacridine, euflavine), biguanides including polymeric biguanides, and amidines (polyaminopropyl biguanide, dibrompropamidine, chlorhexidine, alexidine, propamidine, hexamidine, polihexanide), nitrofuran derivatives (nitrofurazone), quinoline derivatives (dequalinium, chlorquinaldol, oxyquinoline, clioquinol), iodine products, essential oils (bay, cinnamon, clove, thyme, eucalyptus, peppermint, lemon, tea tree, magnolia extract, menthol, geraniol), cations, Anilides (saclicylanilide, Diphenylureas), salicylic acid esters including menthyl salicylate, methyl salicylate and phenyl salicylate, pyrocatechol, phtalic acid and salts thereof, hexetidine, octenidine, sanguinarine, domiphen bromide, alkylpyridinium chlorides such as cetylpyridinium chloride, tetradecylpyridinium chloride and N-tetradecyl-4-ethylpyridinium chloride, iodine, sulfonamides, piperidino derivatives such as delmopinol and octapinol, and mixtures thereof, miscellaneous preservatives (derivatives of 1,3-dioxane, derivatives of imidazole, Isothizolones, derivatives of hexamine, triazines, oxazolo-oxazoles, sodium hydroxymethylglycinate, methylene bisthiocyanate, captan).

Preferred antibacterial systems are halogenated benzyl alcohol derivatives such as chloroxylenol (PCMX), halogenated hydroxydiphenylethers preferably diclosan, quaternary ammonium salts preferably alkylbenzalkonium and alkylbenzethonium chloride and derivatives thereof, essential oils, bleach system preferably a peroxide bleach, and mixtures thereof. Most preferred antibacterial systems are benzalkonium chloride, diclosan and PCMX.

Encapsulates. The composition may comprise an encapsulate, for example an encapsulate comprising a core, a shell having an inner and outer surface, said shell encapsulating said core. The core may comprise any laundry care adjunct, though typically the core may comprise material selected from the group consisting of perfumes; brighteners; dyes; insect repellants; silicones; waxes; flavors; vitamins; fabric softening agents; skin care agents in one aspect, paraffins; enzymes; anti-bacterial agents; bleaches; sensates; and mixtures thereof; and said shell may comprise a material selected from the group consisting of polyethylenes; polyamides; polyvinylalcohols, optionally containing other co-monomers; polystyrenes; polyisoprenes; polycarbonates; polyesters; polyacrylates; aminoplasts, in one aspect said aminoplast may comprise a polyureas, polyurethane, and/or polyureaurethane, in one aspect said polyurea may comprise polyoxymethyleneurea and/or melamine formaldehyde; polyolefins; polysaccharides, in one aspect said polysaccharide may comprise alginate and/or chitosan; gelatin; shellac; epoxy resins; vinyl polymers; water insoluble inorganics; silicone; and mixtures thereof. Preferred encapsulates comprise perfume. Preferred encapsulates comprise a shell which may comprise melamine formaldehyde and/or cross linked melamine formaldehyde. Preferred encapsulates comprise a core material and a shell, said shell at least partially surrounding said core material, is disclosed. At least 75%, 85% or even 90% of said encapsulates may have a fracture strength of from 0.2 MPa to 10 MPa, and a benefit agent leakage of from 0% to 20%, or even less than 10% or 5% based on total initial encapsulated benefit agent. Preferred are those in which at least 75%, 85% or even 90% of said encapsulates may have (i) a particle size of from 1 microns to 80 microns, 5 microns to 60 microns, from 10 microns to 50 microns, or even from 15 microns to 40 microns, and/or (ii) at least 75%, 85% or even 90% of said encapsulates may have a particle wall thickness of from 30 nm to 250 nm, from 80 nm to 180 nm, or even from 100 nm to 160 nm. Formaldehyde scavengers may be employed with the encapsulates, for example, in a capsule slurry and/or added to a composition before, during or after the encapsulates are added to such composition. Suitable capsules that can be made by following the teaching of USPA 2008/0305982 A1; and/or USPA 2009/0247449 A1. Alternatively, suitable capsules can be purchased from Appleton Papers Inc. of Appleton, Wisconsin USA.

In a preferred aspect the composition may comprise a deposition aid, preferably in addition to encapsulates. Preferred deposition aids are selected from the group consisting of cationic and nonionic polymers. Suitable polymers include cationic starches, cationic hydroxyethylcellulose, polyvinylformaldehyde, locust bean gum, mannans, xyloglucans, tamarind gum, polyethyleneterephthalate and polymers containing dimethylaminoethyl methacrylate, optionally with one or more monomers selected from the group comprising acrylic acid and acrylamide.

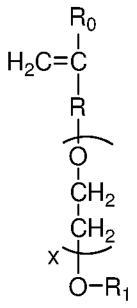
Perfume. Preferred compositions of the invention comprise perfume. Typically the composition comprises a perfume that comprises one or more perfume raw materials, selected from the group as described in WO08/87497. However, any perfume useful in a detergent may be used. A preferred method of incorporating perfume into the compositions of the invention is via an encapsulated perfume particle comprising either a water-soluble hydroxylic compound or melamine-formaldehyde or modified polyvinyl alcohol. In one aspect the encapsulate comprises (a) an at least partially water-soluble solid matrix comprising one or more water-soluble hydroxylic compounds, preferably starch; and (b) a perfume oil encapsulated by the solid matrix. In a further aspect the perfume may be pre-complexed with a polyamine, preferably a polyethylenimine so as to form a Schiff base.

Polymers. The detergent composition may comprise one or more polymers in addition to the DTI which may be polymeric. Examples are optionally modified carboxymethylcellulose, poly (ethylene glycol), poly(vinyl alcohol), polycarboxylates such as polyacrylates, maleic/acrylic acid copolymers and lauryl methacrylate/acrylic acid co-polymers and carboxylate polymers.

Suitable carboxylate polymers include maleate/acrylate random copolymer or polyacrylate homopolymer. The carboxylate polymer may be a polyacrylate homopolymer having a molecular weight of from 4,000 Da to 9,000 Da, or from 6,000 Da to 9,000 Da. Other suitable carboxylate polymers are co-polymers of maleic acid and acrylic acid, and may have a molecular weight in the range of from 4,000 Da to 90,000 Da.

Other suitable carboxylate polymers are co-polymers comprising: (i) from 50 to less than 98 wt% structural units derived from one or more monomers comprising carboxyl groups; (ii) from 1 to less than 49 wt% structural units derived from one or more monomers comprising sulfonate moieties; and (iii) from 1 to 49 wt% structural units derived from one or more types of monomers selected from ether bond-containing monomers represented by formulas (I) and (II):

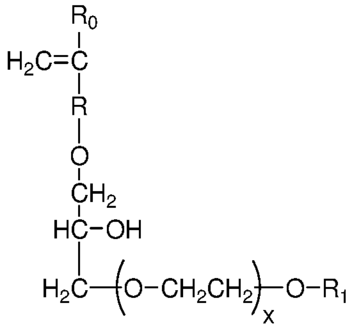
formula (I):



$$H_2C=C(R_0)-R-(O-CH_2-CH_2)_X-O-R_1$$

wherein in formula (I), R_0 represents a hydrogen atom or CH_3 group, R represents a CH_2 group, CH_2CH_2 group or single bond, X represents a number 0-5 provided X represents a number 1-5 when R is a single bond, and R_1 is a hydrogen atom or C1 to C20 organic group;

formula (II)



in formula (II), R_0 represents a hydrogen atom or CH_3 group, R represents a CH_2 group, CH_2CH_2 group or single bond, X represents a number 0-5, and R_1 is a hydrogen atom or C1 to C20 organic group.

The composition may comprise one or more amphiphilic cleaning polymers such as the compound having the following general structure: $bis((C_2H_5O)(C_2H_4O)n)(CH_3)\text{-}N^+\text{-}C_xH_{2x}\text{-}N^+\text{-}(CH_3)\text{-}bis((C_2H_5O)(C_2H_4O)n)$, wherein n = from 20 to 30, and x = from 3 to 8, or sulphated or sulphonated variants thereof. In one aspect, this polymer is sulphated or sulphonated to provide a zwitterionic soil suspension polymer.

The composition preferably comprises amphiphilic alkoxylated grease cleaning polymers which have balanced hydrophilic and properties such that they remove grease particles from fabrics and surfaces. Preferred amphiphilic alkoxylated grease cleaning polymers comprise a core structure and a plurality of alkoxylate groups attached to that core structure. These may comprise alkoxylated polyalkylenimines, preferably having an inner polyethylene oxide block and an outer polypropylene oxide block. Typically these may be incorporated into the compositions of the invention in amounts of from 0.005 to 10 wt%, generally from 0.5 to 8 wt%.

Alkoxylated polycarboxylates such as those prepared from polyacrylates are useful herein to provide additional grease removal performance. Such materials are described in WO 91/08281 and PCT 90/01815. Chemically, these materials comprise polyacrylates having one ethoxy side-chain per every 7-8 acrylate units. The side-chains are of the formula $-(CH_2CH_2O)_m(CH_2)_nCH_3$ wherein m is 2-3 and n is 6-12. The side-chains are ester-linked to the polyacrylate "backbone" to provide a "comb" polymer type structure. The molecular weight can vary, but is typically in the range of about 2000 to about 50,000. Such alkoxylated polycarboxylates can comprise from about 0.05% to about 10%, by weight, of the compositions herein.

The composition may comprise polyethylene glycol polymers and these may be particularly preferred in compositions comprising mixed surfactant systems. Suitable polyethylene glycol polymers include random graft co-polymers comprising: (i) hydrophilic backbone comprising polyethylene glycol; and (ii) side chain(s) selected from the group consisting of: C4-C25 alkyl group, polypropylene, polybutylene, vinyl ester of a saturated C1-C6 mono-carboxylic acid, C1-C 6 alkyl ester of acrylic or methacrylic acid, and mixtures thereof. Suitable polyethylene glycol polymers have a polyethylene glycol backbone with random grafted polyvinyl acetate side chains. The average molecular weight of the polyethylene glycol backbone can be in the range of from 2,000 Da to 20,000 Da, or from 4,000 Da to 8,000 Da. The molecular weight ratio of the polyethylene glycol backbone to the polyvinyl acetate side chains can be in the range of from 1:1 to 1:5, or from 1:1.2 to 1:2. The average number of graft sites per ethylene oxide units can be less than 1, or less than 0.8, the average number of graft sites per ethylene oxide units can be in the range of from 0.5 to 0.9, or the average number of graft sites per ethylene oxide units can be in the range of from 0.1 to 0.5, or from 0.2 to 0.4. A suitable polyethylene glycol polymer is Sokalan HP22.

Typically these are incorporated into the compositions of the invention in amounts from 0.005 to 10 wt%, more usually from 0.05 to 8 wt%.

Preferably the composition comprises one or more carboxylate polymer, such as a maleate/acrylate random copolymer or polyacrylate homopolymer. In one aspect, the carboxylate polymer is a polyacrylate homopolymer having a molecular weight of from 4,000 Da to 9,000 Da, or from 6,000 Da to 9,000 Da. Typically these are incorporated into the compositions of the invention in amounts from 0.005 to 10 wt%, or from 0.05 to 8 wt%.

Preferably the composition comprises one or more soil release polymers. Examples include soil release polymers having a structure as defined by one of the following Formulae (VI), (VII) or (VIII):

(VI) $-[(OCHR^1-CHR^2)_a-O-OC-Ar-CO-]_d$

(VII) $-[(OCHR^3-CHR^4)_b-O-OC-sAr-CO-]_e$

(VIII) $-[(OCHR^5-CHR^6)_c-OR^7]_f$

wherein:

a, b and c are from 1 to 200;

d, e and f are from 1 to 50;

Ar is a 1,4-substituted phenylene;

sAr is 1,3-substituted phenylene substituted in position 5 with SO_3Me;

Me is Li, K, Mg/2, Ca/2, Al/3, ammonium, mono-, di-, tri-, or tetraalkylammonium wherein the alkyl groups are C_1-C_{18} alkyl or C_2-C_{10} hydroxyalkyl, or mixtures thereof;

R^1, R^2, R^3, R^4, R^5 and R^6 are independently selected from H or C_1-C_{18} n- or iso-alkyl; and

R^7 is a linear or branched C_1-C_{18} alkyl, or a linear or branched C_2-C_{30} alkenyl, or a cycloalkyl group with 5 to 9 carbon atoms, or a C_8-C_{30} aryl group, or a C_6-C_{30} arylalkyl group.

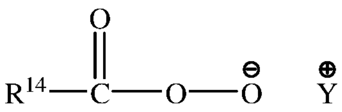
Suitable soil release polymers are polyester soil release polymers such as Repel-o-tex polymers, including Repel-o-tex SF, SF-2 and SRP6 supplied by Rhodia. Other suitable soil release polymers include Texcare polymers, including Texcare SRA100, SRA300, SRN100, SRN170, SRN240, SRN300 and SRN325 supplied by Clariant. Other suitable soil release polymers are Marloquest polymers, such as Marloquest SL supplied by Sasol.

Preferably the composition comprises one or more cellulosic polymer, including those selected from alkyl cellulose, alkyl alkoxyalkyl cellulose, carboxyalkyl cellulose, alkyl carboxyalkyl cellulose. Preferred cellulosic polymers are selected from the group comprising carboxymethyl cellulose, methyl cellulose, methyl hydroxyethyl cellulose, methyl carboxymethyl cellulose, and mixures thereof. In one aspect, the carboxymethyl cellulose has a degree of carboxymethyl substitution from 0.5 to 0.9 and a molecular weight from 100,000 Da to 300,000 Da.

Bleaching Agents. It may be preferred for the composition to comprise one or more bleaching agents. Suitable bleaching agents other than bleaching catalysts include photobleaches, bleach activators, hydrogen peroxide, sources of hydrogen peroxide, pre-formed peracids and mixtures thereof. In general, when a bleaching agent is used, the compositions of the present invention may comprise from about 0.1% to about 50% or even from about 0.1% to about 25% bleaching agent or mixtures of bleaching agents by weight of the subject composition. Examples of suitable bleaching agents include:

(1) photobleaches for example sulfonated zinc phthalocyanine sulfonated aluminium phthalocyanines, xanthene dyes and mixtures thereof;

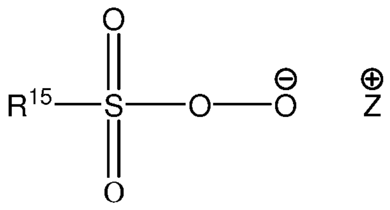
(2) pre-formed peracids: Suitable preformed peracids include, but are not limited to compounds selected from the group consisting of pre-formed peroxyacids or salts thereof typically a percarboxylic acids and salts, percarbonic acids and salts, perimidic acids and salts, peroxymonosulfuric acids and salts, for example, Oxone ®, and mixtures thereof. Suitable examples include peroxycarboxylic acids or salts thereof, or peroxysulphonic acids or salts thereof. Typical peroxycarboxylic acid salts suitable for use herein have a chemical structure corresponding to the following chemical formula:



$$R^{14}-\overset{\overset{\displaystyle O}{\|}}{C}-O-\overset{\ominus}{O}\quad \overset{\oplus}{Y}$$

wherein: R^{14} is selected from alkyl, aralkyl, cycloalkyl, aryl or heterocyclic groups; the R^{14} group can be linear or branched, substituted or unsubstituted; having, when the peracid is , from 6 to 14 carbon atoms, or from 8 to 12 carbon atoms and, when the peracid is hydrophilic, less than 6 carbon atoms or even less than 4 carbon atoms and Y is any suitable counter-ion that achieves electric charge neutrality, preferably Y is selected from hydrogen, sodium or potassium. Preferably, R^{14} is a linear or branched, substituted or unsubstituted $C_{6\text{-}9}$ alkyl. Preferably, the peroxyacid or salt thereof is selected from peroxyhexanoic acid, peroxyheptanoic acid, peroxyoctanoic acid, peroxynonanoic acid, peroxydecanoic acid, any salt thereof, or any combination thereof. Particularly preferred peroxyacids are phthalimido-peroxy-alkanoic acids, in particular ε-phthalimido peroxy hexanoic acid (PAP). Preferably, the peroxyacid or salt thereof has a melting point in the range of from 30°C to 60°C.

The pre-formed peroxyacid or salt thereof can also be a peroxysulphonic acid or salt thereof, typically having a chemical structure corresponding to the following chemical formula:



$$R^{15}-\underset{\underset{\displaystyle O}{\|}}{\overset{\overset{\displaystyle O}{\|}}{S}}-O-\overset{\ominus}{O}\quad \overset{\oplus}{Z}$$

wherein: R^{15} is selected from alkyl, aralkyl, cycloalkyl, aryl or heterocyclic groups; the R^{15} group can be linear or branched, substituted or unsubstituted; and Z is any suitable counter-ion that achieves electric charge neutrality, preferably Z is selected from hydrogen, sodium or potassium. Preferably R^{15} is a linear or branched, substituted or unsubstituted $C_{4\text{-}14,}$ preferably $C_{6\text{-}14}$ alkyl. Preferably such bleach components may be present in the compositions of the invention in an amount from 0.01 to 50%, most preferably from 0.1% to 20%.

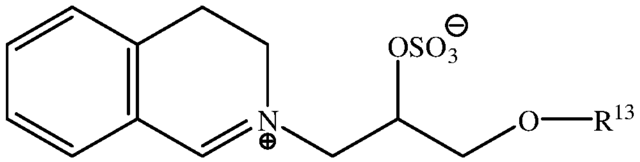
(3) sources of hydrogen peroxide, for example, inorganic perhydrate salts, including alkali metal salts such as sodium salts of perborate (usually mono- or tetra-hydrate), percarbonate, persulphate, perphosphate, persilicate salts and mixtures thereof. In one aspect of the invention the inorganic perhydrate salts are selected from the group consisting of sodium

salts of perborate, percarbonate and mixtures thereof. When employed, inorganic perhydrate salts are typically present in amounts of from 0.05 to 40 wt%, or 1 to 30 wt% of the overall fabric and home care product and are typically incorporated into such fabric and home care products as a crystalline solid that may be coated. Suitable coatings include, inorganic salts such as alkali metal silicate, carbonate or borate salts or mixtures thereof, or organic materials such as water-soluble or dispersible polymers, waxes, oils or fatty soaps; and

(4) bleach activators having R-(C=O)-L wherein R is an alkyl group, optionally branched, having, when the bleach activator is , from 6 to 14 carbon atoms, or from 8 to 12 carbon atoms and, when the bleach activator is hydrophilic, less than 6 carbon atoms or even less than 4 carbon atoms; and L is leaving group. Examples of suitable leaving groups are benzoic acid and derivatives thereof - especially benzene sulphonate. Suitable bleach activators include dodecanoyl oxybenzene sulphonate, decanoyl oxybenzene sulphonate, decanoyl oxybenzoic acid or salts thereof, 3,5,5-trimethyl hexanoyloxybenzene sulphonate, tetraacetyl ethylene diamine (TAED) and nonanoyloxybenzene sulphonate (NOBS). Suitable bleach activators are also disclosed in WO 98/17767. While any suitable bleach activator may be employed, in one aspect of the invention the subject composition may comprise NOBS, TAED or mixtures thereof.

(5) Bleach Catalysts. The compositions of the present invention may also include one or more bleach catalysts capable of accepting an oxygen atom from a peroxyacid and/or salt thereof, and transferring the oxygen atom to an oxidizeable substrate. Suitable bleach catalysts include, but are not limited to: iminium cations and polyions; iminium zwitterions; modified amines; modified amine oxides; N-sulphonyl imines; N-phosphonyl imines; N-acyl imines; thiadiazole dioxides; perfluoroimines; cyclic sugar ketones and alpha amino-ketones and mixtures thereof. Suitable alpha amino ketones are for example as described in WO 2012/000846 A1, WO 2008/015443 A1, and WO 2008/014965 A1. Suitable mixtures are as described in USPA 2007/0173430 A1.

In one aspect, the bleach catalyst has a structure corresponding to general formula below:



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

(6) The composition may preferably comprise catalytic metal complexes. One preferred type of metal-containing bleach catalyst is a catalyst system comprising a transition metal cation of defined bleach catalytic activity, such as copper, iron, titanium, ruthenium, tungsten, molybdenum, or manganese cations, an auxiliary metal cation having little or no bleach catalytic activity, such as zinc or aluminum cations, and a sequestrate having defined stability constants for the catalytic and auxiliary metal cations, particularly ethylenediaminetetraacetic acid, ethylenediaminetetra(methylenephosphonic acid) and water-soluble salts thereof. Such catalysts are disclosed in U.S. 4,430,243.

If desired, the compositions herein can be catalyzed by means of a manganese compound. Such compounds and levels of use are well known in the art and include, for example, the manganese-based catalysts disclosed in U.S. 5,576,282.

Cobalt bleach catalysts useful herein are known, and are described, for example, in U.S. 5,597,936; U.S. 5,595,967. Such cobalt catalysts are readily prepared by known procedures, such as taught for example in U.S. 5,597,936, and U.S. 5,595,967.

Compositions herein may also suitably include a transition metal complex of ligands such as bispidones (WO 05/042532 A1) and/or macropolycyclic rigid ligands - abbreviated as "MRLs". As a practical matter, and not by way of limitation, the compositions and processes herein can be adjusted to provide on the order of at least one part per hundred million of the active MRL species in the aqueous washing medium, and will typically provide from about 0.005 ppm to about 25 ppm, from about 0.05 ppm to about 10 ppm, or even from about 0.1 ppm to about 5 ppm, of the MRL in the wash liquor.

Suitable transition-metals in the instant transition-metal bleach catalyst include, for example, manganese, iron and chromium. Suitable MRLs include 5,12-diethyl-1,5,8,12-tetraazabicyclo[6.6.2]hexadecane.

Suitable transition metal MRLs are readily prepared by known procedures, such as taught for example in WO 00/32601, and U.S. 6,225,464.

When present, the source of hydrogen peroxide/peracid and/or bleach activator is generally present in the composition in an amount of from about 0.1 to about 60 wt%, from about 0.5 to about 40 wt % or even from about 0.6 to about 10 wt% based on the fabric and home care product. One or more peracids or precursors thereof may be used in combination with one or more hydrophilic peracid or precursor thereof.

Typically hydrogen peroxide source and bleach activator will be incorporated together .The amounts of hydrogen peroxide source and peracid or bleach activator may be selected such that the molar ratio of available oxygen (from the peroxide source) to peracid is from 1:1 to 35:1, or even 2:1 to 10:1.

Builders. Preferably the composition comprises one or more builders or a builder system. When a builder is used, the composition of the invention will typically comprise at least 1%, or at least 2% to 60% builder. Suitable builders include for example zeolite, phosphate, citrate, etc. It may be preferred that the composition comprises low levels of phosphate salt and/or zeolite, for example from 1 to 10 or 5 wt%. The composition may even be substantially free of strong builder; substantially free of strong builder means "no deliberately added" zeolite and/or phosphate. Typical zeolite builders include zeolite A, zeolite P and zeolite MAP. A typical phosphate builder is sodium tri-polyphosphate.

Chelating Agent. Preferably the composition comprises chelating agents and/or crystal growth inhibitor. Suitable molecules include copper, iron and/or manganese chelating agents and mixtures thereof. Suitable molecules include aminocarboxylates, aminophosphonates, succinates, salts thereof, and mixtures thereof. Non-limiting examples of suitable chelants for use herein include ethylenediaminetetracetates, N- (hydroxyethyl)ethylenediaminetriacetates, nitrilotriacetates, ethylenediamine tetraproprionates, triethylenetetraaminehexacetates, diethylenetriamine-pentaacetates, ethanoldiglycines, ethylenediaminetetrakis (methylenephosphonates), diethylenetriamine penta(methylene phosphonic acid) (DTPMP), ethylenediamine disuccinate (EDDS), hydroxyethanedimethylenephosphonic acid (HEDP), methylglycinediacetic acid (MGDA), diethylenetriaminepentaacetic acid (DTPA), salts thereof, and mixtures thereof. Other nonlimiting examples of chelants of use in the present invention are found in U.S. Patent Nos. 7445644, 7585376 and 2009/0176684A1. Other suitable chelating agents for use herein are the commercial DEQUEST series, and chelants from Monsanto, DuPont, and Nalco, Inc.

pH Modifiers. pH modifiers may be incorporated to generate the desired pH. Any alkali or acid may be added known to those skilled in the art of detergent manufacture, for example, sodium or potassium hydroxide carbonate or silicate, citric acid, or stronger acids such as hydrochloric acid. Those pH modifiers which add buffering capacity may be particularly preferred.

Silicate Salts. The composition may preferably also contain silicate salts, such as sodium or potassium silicate. The composition may comprise from 0wt% to less than 10wt% silicate salt, to 9wt%, or to 8wt%, or to 7wt%, or to 6wt%, or to 5wt%, or to 4wt%, or to 3wt%, or even to 2wt%, and preferably from above 0wt%, or from 0.5wt%, or even from 1wt% silicate salt. A suitable silicate salt is sodium silicate.

Dispersants. The composition may preferably also contain dispersants. Suitable water-soluble organic materials include the homo- or co-polymeric acids or their salts, in which the polycarboxylic acid comprises at least two carboxyl radicals separated from each other by not more than two carbon atoms.

Enzyme Stabilisers. The composition may preferably comprise enzyme stabilizers. Any conventional enzyme stabilizer may be used, for example by the presence of water-soluble sources of calcium and/or magnesium ions in the finished fabric and home care products that provide such ions to the enzymes. In case of aqueous compositions comprising protease, a reversible protease inhibitor, such as a boron compound including borate, or preferably 4-formyl phenylboronic acid, phenylboronic acid and derivatives thereof, or compounds such as calcium formate, sodium formate and 1,2-propane diol, diethylene glycol can be added to further improve stability.

Fabric Shading Dye

The composition may comprise fabric shading dye. Suitable fabric shading dye (sometimes referred to as hueing, bluing or whitening agents) typically provides a blue or violet shade to fabric. Fabric shading dyes can be used either alone or in combination to create a specific shade of hueing and/or to shade different fabric types. This may be provided for example by mixing a red and green-blue dye to yield a blue or violet shade. The fabric shading dye may be selected from any known chemical class of dye, including but not limited to acridine, anthraquinone (including polycyclic quinones), azine, azo (e.g., monoazo, disazo, trisazo, tetrakisazo, polyazo), including premetallized azo, benzodifurane and benzodifuranone, carotenoid, coumarin, cyanine, diazahemicyanine, diphenylmethane, formazan, hemicyanine, indigoids, methane, naphthalimides, naphthoquinone, nitro and nitroso, oxazine, phthalocyanine, pyrazoles, stilbene, styryl, triarylmethane, triphenylmethane, xanthenes and mixtures thereof.

Suitable fabric shading dyes include dyes and dye-clay conjugates. Preferred fabric shading dyes are selected from small molecule dyes and polymeric dyes. Suitable small molecule dyes include small molecule dyes selected from the group consisting of dyes falling into the Colour Index (C.I.) classifications of Acid, Direct, Basic, Reactive, Solvent or Disperse dyes for example that are classified as Blue, Violet, Red, Green or Black, and provide the desired shade either alone or in combination with other dyes or in combination with other adjunct ingredients. Dyes described as hydrolysed Reactive dyes, as described in EP-A-1794274 may also be included. In another aspect, suitable small molecule dyes include small molecule dyes selected from the group consisting of Colour Index (Society of Dyers and Colourists, Bradford, UK) numbers Direct Violet dyes such as 5, 7, 9, 11, 31, 35, 48, 51, 66, and 99, Direct Blue dyes such as 1, 71, 80 and 279, Acid Red dyes such as 17, 73, 52, 88 and 150, Acid Violet dyes such as 15, 17, 24, 43, 49 and 50, Acid Blue dyes such as 15, 17, 25, 29, 40, 45, 48, 75, 80, 83, 90 and 113, Acid Black dyes such as 1, Basic Violet dyes such as 1, 3, 4, 10 and 35, Basic Blue dyes such as 3, 16, 22, 47, 66, 75 and 159, Disperse or Solvent dyes such as those described in US 2008/034511 A1 or US 8,268,016 B2, or dyes as disclosed in US 7,208,459 B2, such as solvent violet 13 and mixtures thereof. In another aspect, suitable small molecule dyes include small molecule dyes selected from the group consisting of C. I. numbers Acid Violet 17, Acid Blue 80, Acid Violet 50, Direct Blue 71, Direct Violet 51, Direct Blue 1, Acid Red 88, Acid Red 150, Acid Blue 29, Acid Blue 113 or mixtures thereof.

Suitable polymeric dyes include polymeric dyes selected from the group consisting of polymers containing covalently bound (sometimes referred to as conjugated) chromogens, (dye-polymer conjugates), for example polymers with chromogens co-polymerized into the backbone of the polymer and mixtures thereof. Polymeric dyes include those described in WO2011/98355, US 2012/225803 A1, US 2012/090102 A1, WO2012/166768, US 7,686,892 B2, and WO2010/142503.

Other suitable polymeric dyes include polymeric dyes selected from the group consisting of fabric-substantive colorants sold under the name of Liquitint® (Milliken, Spartanburg, South Carolina, USA), dye-polymer conjugates formed from at least one reactive dye and a polymer selected from the group consisting of polymers comprising a moiety selected from the group consisting of a hydroxyl moiety, a primary amine moiety, a secondary amine moiety, a thiol moiety and mixtures thereof. In still another aspect, suitable polymeric dyes include polymeric dyes selected from the group consisting of Liquitint® Violet CT, carboxymethyl cellulose (CMC) covalently bound to one or more reactive blue, reactive violet or reactive red dye such as CMC conjugated with C.I. Reactive Blue 19, sold by Megazyme, Wicklow, Ireland under the product name AZO-CM-CELLULOSE, product code S-ACMC, alkoxylated triphenyl-methane polymeric colourants, alkoxylated thiophene polymeric colourants, alkoxylated carbocyclic and alkoxylated heterocyclic azo colourants, and mixtures thereof. Preferred polymeric dyes comprise the optionally substituted alkoxylated dyes, such as alkoxylated triphenyl-methane polymeric colourants, alkoxylated thiophene polymeric colourants, alkoxylated carbocyclic and alkoxylated heterocyclic azo colourants, and mixtures thereof, such as the Liquitint dyes.

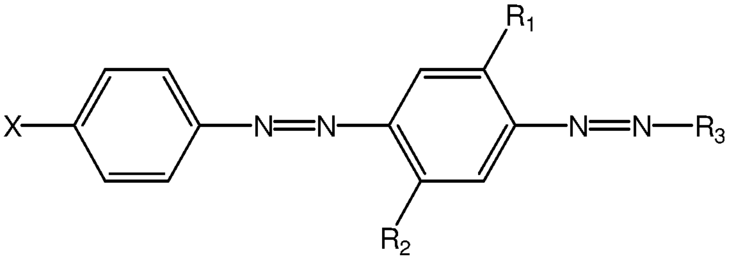
Preferred hueing dyes include the whitening agents found in WO 08/87497 A1, WO2011/011799 and US 2012/129752 A1. Preferred hueing agents for use in the present invention may be the preferred dyes disclosed in these references, including those selected from Examples 1-42 in Table 5 of WO2011/011799. Other preferred dyes are disclosed in US 8,138,222. Other preferred dyes are disclosed in US 7,909,890 B2.

Suitable dye clay conjugates include dye clay conjugates selected from the group comprising at least one cationic/basic dye and a smectite clay, and mixtures thereof. In another aspect, suitable dye clay conjugates include dye clay conjugates selected from the group consisting of one cationic/basic dye and a clay selected from the group consisting of Montmorillonite clay, Hectorite clay, Saponite clay and mixtures thereof. Examples of suitable cationic/basic dyes include C.I. Basic Yellow 1 through 108, C.I. Basic Orange 1 through 69, C.I. Basic Red 1 through 118, C.I. Basic Violet 1 through 51, C.I. Basic Blue 1 through 164, C.I. Basic Green 1 through 14, C.I. Basic Brown 1 through 23, CI Basic Black 1 through 11, In still another aspect, suitable dye clay conjugates include dye clay conjugates selected from the group consisting of: Montmorillonite Basic Blue B7 C.I. 42595 conjugate, Montmorillonite Basic Blue B9 C.I. 52015 conjugate, Montmorillonite Basic Violet V3 C.I. 42555 conjugate, Montmorillonite Basic Green G1 C.I. 42040 conjugate, Montmorillonite Basic Red R1 C.I. 45160 conjugate, Montmorillonite C.I. Basic Black 2 conjugate, Hectorite Basic Blue B7 C.I. 42595 conjugate, Hectorite Basic Blue B9 C.I. 52015 conjugate, Hectorite Basic Violet V3 C.I. 42555 conjugate, Hectorite Basic Green G1 C.I. 42040 conjugate, Hectorite Basic Red R1 C.I. 45160 conjugate, Hectorite C.I. Basic Black 2 conjugate, Saponite Basic Blue B7 C.I. 42595 conjugate, Saponite Basic Blue B9 C.I. 52015 conjugate, Saponite Basic Violet V3 C.I. 42555 conjugate, Saponite Basic Green G1 C.I. 42040 conjugate, Saponite Basic Red R1 C.I. 45160 conjugate, Saponite C.I. Basic Black 2 conjugate and mixtures thereof.

The fabric shading dye or indeed other adjuncts made by organic synthesis routes such as pigment, optical brightener, polymer may be incorporated into the detergent composition as part of a reaction mixture which is the result of the organic synthesis for the adjunct with optional purification step(s). Such reaction mixtures generally comprise the adjunct itself and in addition may comprise un-reacted starting materials and/or by-products of the organic synthesis route.

Suitable polymeric fabric shading dyes are illustrated below. As with all such alkoxylated compounds, the organic synthesis may produce a mixture of molecules having different degrees of alkoxylation. Such mixtures may be used directly to provide the fabric shading dye, or may undergo a purification step.

The fabric shading dye may have the following structure:



wherein:

R_1 and R_2 are independently selected from the group consisting of: H; alkyl; alkoxy; alkyleneoxy; alkyl capped alkyleneoxy; urea; and amido;

R_3 is a substituted aryl group;

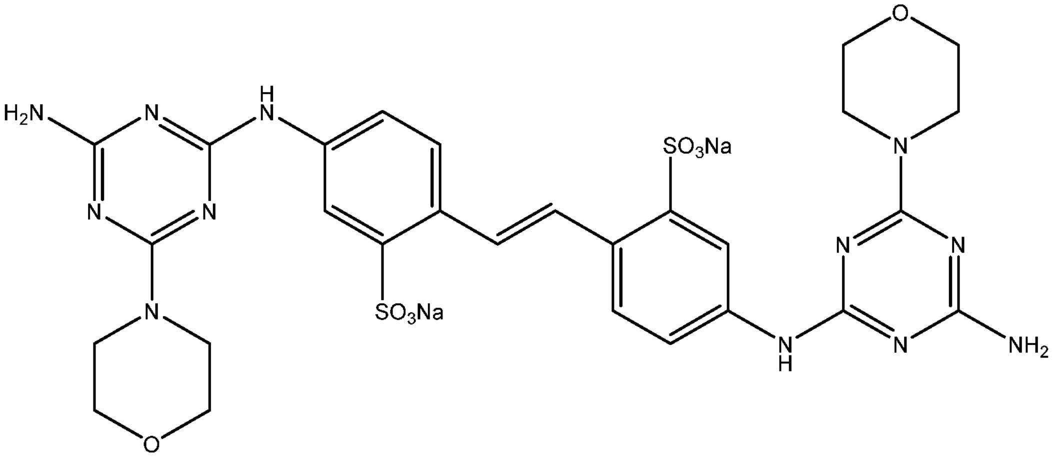
X is a substituted group comprising sulfonamide moiety and optionally an alkyl and/or aryl moiety, and wherein the substituent group comprises at least one alkyleneoxy chain. The hueing dye may be a thiophene dye such as a thiophene azo dye, preferably alkoxylated. Optionally the dye may be substituted with at least one solubilising group selected from sulphonic, carboxylic or quaternary ammonium groups. A preferred dye is Violet DD from Milliken, or dyes as described in

Pigments. Suitable pigments include pigments selected from the group consisting of flavanthrone, indanthrone, chlorinated indanthrone containing from 1 to 4 chlorine atoms, pyranthrone, dichloropyranthrone, monobromodichloropyranthrone, dibromodichloropyranthrone, tetrabromopyranthrone, perylene-3,4,9,10-tetracarboxylic acid diimide, wherein the imide groups may be unsubstituted or substituted by C1-C3 -alkyl or a phenyl or heterocyclic radical, and wherein the phenyl and heterocyclic radicals may additionally carry substituents which do not confer solubility in water, anthrapyrimidinecarboxylic acid amides, violanthrone, isoviolanthrone, dioxazine pigments, copper phthalocyanine which may contain up to 2 chlorine atoms per molecule, polychloro-copper phthalocyanine or polybromochloro-copper phthalocyanine containing up to 14 bromine atoms per molecule and mixtures thereof. Other suitable pigments are described in WO2008/090091. In another aspect, suitable pigments include pigments selected from the group consisting of Ultramarine Blue (C.I. Pigment Blue 29), Ultramarine Violet (C.I. Pigment Violet 15), Monastral Blue and mixtures thereof. Particularly preferred are Pigment Blues 15 to 20, especially Pigment Blue 15 and/or 16. Other suitable pigments include those selected from the group consisting of Ultramarine Blue (C.I. Pigment Blue 29), Ultramarine Violet (C.I. Pigment Violet 15), Monastral Blue and mixtures thereof. Suitable hueing agents are described in more detail in US 7,208,459 B2.

The aforementioned fabric hueing agents can be used in mixtures of hueing agents and/or in mixtures with any pigment.

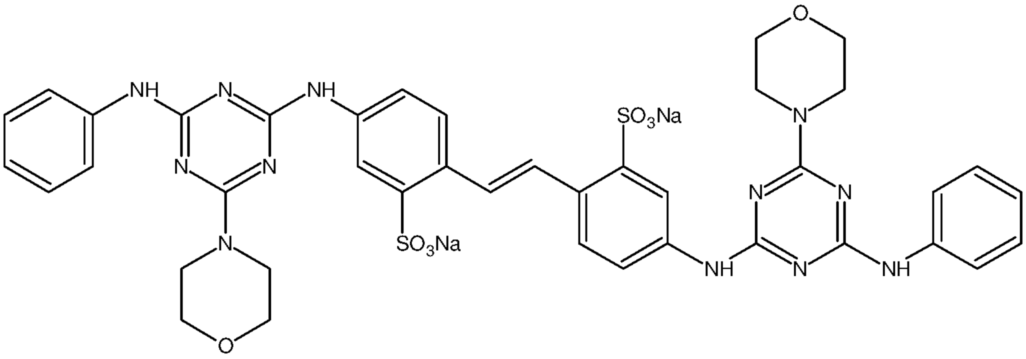
Optical Brighteners. Suitable examples of optical brighteners are for example stilbene brighteners, coumarinic brighteners, benzoxazole brighteners and mixtures thereof. Diaminostilbene disulphonic acid type brighteners (hereinafter referred to as "DAS") are classified as hydrophilic in WO-A-98/52907. A commercial example of a DAS is Tinopal DMS (ex CIBA). Another type of low ClogP brightener is a distyrylbiphenyl brightener (hereinafter referred to as "DSBP"). A commercial example of this type of brightener is Tinopal CBS-X (also ex CIBA). Commercial optical brighteners which may be useful in the present invention can be classified into subgroups, which include, but are not limited to, derivatives of stilbene, pyrazoline, carboxylic acid, methinecyanines, dibenzothiophene-5,5-dioxide, azoles, 5- and 6-membered-ring heterocycles, and other miscellaneous agents. Particularly preferred brighteners are selected from: sodium 2 (4-styryl-3-sulfophenyl) -2H-naphtho [1 , 2-d] triazole, disodium 4,4'-bis([4-anilino-6-(N-methyl-2-hydroxyethylamino)-1,3,5-triazin-2-yl]amino)stilbene-2,2'-disulfonate, disodium 4,4'-bis[(4-anilino-6-morpholino-1,3,5-triazin-2-yl)amino]stilbene-2,2'-disulfonate, and disodium 4,4'-bis(2-sulfostyryl)biphenyl. Other examples of such brighteners are disclosed in "The Production and Application of Fluorescent Brightening Agents", M. Zahradnik, Published by John Wiley & Sons, New York (1982).

A preferred brightener has the structure below:



Suitable levels of brightener are from about 0.01, from about 0.05, from about 0.1 or even from about 0.2 wt % to upper levels of 0.5, of 0.75 or even 1.0 wt %.

A highly preferred optical brightener comprises C.I. fluorescent brightener 260 (preferably having the following structure:



A process for making C.I fluorescent brightener 260 is described in BE680847.

Aesthetic Dyes. The composition may comprise aesthetic dyes and/or pigments. Suitable dyes include any conventional dye, typically small molecule or polymeric, used for colouring cleaning and/or treatment compositions. These are generally non-fabric shading dyes.

Solvent System. The present compositions may comprise a solvent system for example comprising water alone or mixtures of organic solvents either without or with water. Preferred organic solvents include 1,2-propanediol, ethanol, glycerol, dipropylene glycol, methyl propane diol and mixtures thereof. Other lower alcohols, C1-C4 alkanolamines such as monoethanolamine and triethanolamine, can also be used. Solvent systems can be absent, for example from anhydrous solid embodiments of the invention, but more typically are present at levels in the range of from about 0.1% to about 98%, preferably at least about 1% to about 50%, more usually from about 5% to about 25%. Such solvent systems may be particularly useful for pre-mixing with the brightener prior to mixing the brightener with other components in the detergent composition. Alternatively or in addition, surfactant(s) may be pre-mixed with the brightener. In such a preferred embodiment, the surfactant pre-mixed with the brightener comprises at least 25 wt% or at least 50 wt% (based on the total weight of the surfactant) of nonionic surfactant.

In some embodiments of the invention, the composition is in the form of a structured liquid. Such structured liquids can either be internally structured, whereby the structure is formed by primary ingredients (e.g. surfactant material) and/or externally structured by providing a three dimensional matrix structure using secondary ingredients (e.g. polymers, clay and/or silicate material), for use e.g. as thickeners. The composition may comprise a structurant, preferably from 0.01wt% to 5wt%, from 0.1wt% to 2.0wt% structurant. Examples of suitable structurants are given in US2006/0205631A1, US2005/0203213A1, US7294611, US6855680. The structurant is typically selected from the group consisting of diglycerides and triglycerides, ethylene glycol distearate, microcrystalline cellulose, cellulose-based materials, microfiber cellulose, ally modified alkali-swellable emulsions such as Polygel W30 (3VSigma), biopolymers, xanthan gum, gellan gum, hydrogenated castor oil, derivatives of hydrogenated castor oil such as non-ethoxylated derivatieves thereof and mixtures thereof, in particular, those selected from the group of hydrogenated castor oil, derivatives of hydrogenated castor oil, microfibullar cellulose, hydroxyfunctional crystalline materials, long chain fatty alcohols, 12-hydroxystearic acids, clays and mixtures thereof.A preferred structurant is described in . US Patent No. 6,855,680 which defines suitable hydroxyfunctional crystalline materials in detail. Preferred is hydrogenated castor oil. Non-limiting examples of useful structurants include.. Such structurants have a thread-like structuring system having a range of aspect ratios. Other suitable structurants and the processes for making them are described in WO2010/034736.

The composition of the present invention may comprise a high melting point fatty compound. The high melting point fatty compound useful herein has a melting point of 25°C or higher, and is selected from the group consisting of fatty alcohols, fatty acids, fatty alcohol derivatives, fatty acid derivatives, and mixtures thereof. Such compounds of low melting point are not intended to be included in this section. Non-limiting examples of the high melting point compounds are found in International Cosmetic Ingredient Dictionary, Fifth Edition, 1993, and CTFA Cosmetic Ingredient Handbook, Second Edition, 1992. When present, the high melting point fatty compound is preferably included in the composition at a level of from 0.1% to 40%, preferably from 1% to 30%, more preferably from 1.5% to 16% by weight of the composition, from 1.5% to 8% in view of providing improved conditioning benefits such as slippery feel during the application to wet hair, softness and moisturized feel on dry hair.

Cationic Polymer. The compositions of the present invention may contain a cationic polymer. Concentrations of the cationic polymer in the composition typically range from 0.05% to 3%, in another embodiment from 0.075% to 2.0%, and in yet another embodiment from 0.1% to 1.0%. Suitable cationic polymers will have cationic charge densities of at least 0.5 meq/gm, in another embodiment at least 0.9 meq/gm, in another embodiment at least 1.2 meq/gm, in yet another embodiment at least 1.5 meq/gm, but in one embodiment also less than 7 meq/gm, and in another embodiment less than 5 meq/gm, at the pH of intended use of the composition, which pH will generally range from pH 3 to pH 9, in one embodiment between pH 4 and pH 8. Herein, "cationic charge density" of a polymer refers to the ratio of the number of positive charges on the polymer to the molecular weight of the polymer. The average molecular weight of such suitable cationic polymers will generally be between 10,000 and 10 million, in one embodiment between 50,000 and 5 million, and in another embodiment between 100,000 and 3 million.

Suitable cationic polymers for use in the compositions of the present invention contain cationic nitrogen-containing moieties such as quaternary ammonium or cationic protonated amino moieties. Any anionic counterions can be used in association with the cationic polymers so long as the polymers remain soluble in water, in the composition, or in a coacervate phase of the composition, and so long as the counterions are physically and chemically compatible with the essential components of the composition or do not otherwise unduly impair product performance, stability or aesthetics. Nonlimiting examples of such counterions include halides (e.g., chloride, fluoride, bromide, iodide), sulfate and methylsulfate.

Nonlimiting examples of such polymers are described in the CTFA Cosmetic Ingredient Dictionary, 3rd edition, edited by Estrin, Crosley, and Haynes, (The Cosmetic, Toiletry, and Fragrance Association, Inc., Washington, D.C. (1982)).

Other suitable cationic polymers for use in the composition include polysaccharide polymers, cationic guar gum derivatives, quaternary nitrogen-containing cellulose ethers, synthetic polymers, copolymers of etherified cellulose, guar and starch. When used, the cationic polymers herein are either soluble in the composition or are soluble in a complex coacervate phase in the composition formed by the cationic polymer and the anionic, amphoteric and/or zwitterionic surfactant component described hereinbefore. Complex coacervates of the cationic polymer can also be formed with other charged materials in the composition.

Suitable cationic polymers are described in U.S. Pat. Nos. 3,962,418; 3,958,581; and U.S. Publication No. 2007/0207109A1.

Nonionic Polymer. The composition of the present invention may include a nonionic polymer as a conditioning agent. Polyalkylene glycols having a molecular weight of more than 1000 are useful herein. Useful are those having the following general formula:

wherein R95 is selected from the group consisting of H, methyl, and mixtures thereof. Conditioning agents, and in particular silicones, may be included in the composition. The conditioning agents useful in the compositions of the present invention typically comprise a water insoluble, water dispersible, non-volatile, liquid that forms emulsified, liquid particles. Suitable conditioning agents for use in the composition are those conditioning agents characterized generally as silicones (e.g., silicone oils, cationic silicones, silicone gums, high refractive silicones, and silicone resins), organic conditioning oils (e.g., hydrocarbon oils, polyolefins, and fatty esters) or combinations thereof, or those conditioning agents which otherwise form liquid, dispersed particles in the aqueous surfactant matrix herein. Such conditioning agents should be physically and chemically compatible with the essential components of the composition, and should not otherwise unduly impair product stability, aesthetics or performance.

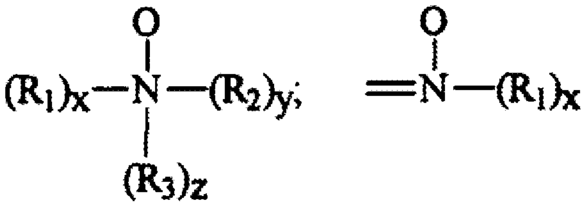
The concentration of the conditioning agent in the composition should be sufficient to provide the desired conditioning benefits. Such concentration can vary with the conditioning agent, the conditioning performance desired, the average size of the conditioning agent particles, the type and concentration of other components, and other like factors.

The concentration of the silicone conditioning agent typically ranges from about 0.01% to about 10%. Non-limiting examples of suitable silicone conditioning agents, and optional suspending agents for the silicone, are described in U.S. Reissue Pat. No. 34,584, U.S. Pat. Nos. 5,104,646; 5,106,609; 4,152,416; 2,826,551; 3,964,500; 4,364,837; 6,607,717; 6,482,969; 5,807,956; 5,981,681; 6,207,782; 7,465,439; 7,041,767; 7,217,777; US Patent Application Nos. 2007/0286837A1; 2005/0048549A1; 2007/0041929A1; British Pat. No. 849,433; German Patent No. DE 10036533, which are all incorporated herein by reference; Chemistry and Technology of Silicones, New York: Academic Press (1968); General Electric Silicone Rubber Product Data Sheets SE 30, SE 33, SE 54 and SE 76; Silicon Compounds, Petrarch Systems, Inc. (1984); and in Encyclopedia of Polymer Science and Engineering, vol. 15, 2d ed., pp 204-308, John Wiley & Sons, Inc. (1989).

Dye Transfer Inhibitor (DTI). The cleaning and/or treatment compositions preferably comprise one or mixtures of more than one dye transfer inhibiting agents. Suitable dye transfer inhibitors are selected from the group consisting of: polyvinylpyrrolidone polymers, polyamine N-oxide polymers, copolymers of N-vinylpyrrolidone and N-vinylimidazole, polyvinyloxazolidones, polyvinylimidazoles and mixtures thereof. Other suitable DTIs are triazines as described in WO2012/095354, polymerized benzoxazines as described in WO2010/130624, polyvinyl tetrazoles as described in DE 102009001144A, porous polyamide particles as described in WO2009/127587 and insoluble polymer particles as described in WO2009/124908. Other suitable DTIs are described in WO2012/004134, or polymers selected from the group consisting of (a) amphiphilic alkoxylated polyamines, amphiphilic graft co-polymers, zwitterionic soil suspension polymers, manganese phthalocyanines, peroxidases and mixtures thereof.

Preferred classes of DTI include but are not limited to polyvinylpyrrolidone polymers, polyamine N-oxide polymers, copolymers of N-vinylpyrrolidone and N-vinylimidazole, polyvinyloxazolidones, polyvinylimidazoles and mixtures thereof. More specifically, the polyamine N-oxide polymers preferred for use herein contain units having the following structural formula: R-AX-P; wherein P is a polymerizable unit to which an N-O group can be attached or the N-O group can form part of the polymerizable unit or the N-O group can be attached to both units; A is one of the following structures: -NC(O)-, -C(O)O-, -S-, -O-, -N=; x is 0 or 1; and R is aliphatic, ethoxylated aliphatics, aromatics, heterocyclic or alicyclic groups or any combination thereof to which the nitrogen of the N-O group can be attached or the N-O group is part of these groups. Preferred polyamine N-oxides are those wherein R is a heterocyclic group such as pyridine, pyrrole, imidazole, pyrrolidine, piperidine and derivatives thereof.

The N-O group can be represented by the following general structures:



$$(R_1)_x-\overset{\overset{\displaystyle O}{|}}{\underset{\underset{\displaystyle (R_3)_z}{|}}{N}}-(R_2)_y; \qquad =\overset{\overset{\displaystyle O}{|}}{N}-(R_1)_x$$

wherein R1, R2, R3 are aliphatic, aromatic, heterocyclic or alicyclic groups or combinations thereof; x, y and z are 0 or 1; and the nitrogen of the N-O group can be attached or form part of any of the aforementioned groups. The amine oxide unit of the polyamine N-oxides has a pKa < 10, preferably pKa < 7, more preferred pKa < 6.

Any polymer backbone can be used as long as the amine oxide polymer formed is water-soluble and has dye transfer inhibiting properties. Examples of suitable polymeric backbones are polyvinyls, polyalkylenes, polyesters, polyethers, polyamide, polyimides, polyacrylates and mixtures thereof. These polymers include random or block copolymers where one monomer type is an amine N-oxide and the other monomer type is an N-oxide. The amine N-oxide polymers typically have a ratio of amine to the amine N-oxide of 10:1 to 1:1,000,000. However, the number of amine oxide groups present in the polyamine oxide polymer can be varied by appropriate copolymerization or by an appropriate degree of N-oxidation. The polyamine oxides can be obtained in almost any degree of polymerization.

Typically, the average molecular weight is within the range of 500 to 1,000,000; more preferred 1,000 to 500,000; most preferred 5,000 to 100,000. This preferred class of materials can be referred to as "PVNO".

The most preferred polyamine N-oxide useful in the detergent compositions herein is poly(4-vinylpyridine-N-oxide) which as an average molecular weight of about 50,000 and an amine to amine N-oxide ratio of about 1:4.

Copolymers of N-vinylpyrrolidone and N-vinylimidazole polymers (referred to as a class as "PVPVI") are also preferred for use herein. Preferably the PVPVI has an average molecular weight range from 5,000 to 1,000,000, more preferably from 5,000 to 200,000, and most preferably from 10,000 to 20,000. (The average molecular weight range is determined by light scattering as described in Barth, et al.,

Chemical Analysis, Vol 113. "Modem Methods of Polymer Characterization", the disclosures of which are incorporated herein by reference.) The PVPVI copolymers typically have a molar ratio of N-vinylimidazole to N-vinylpyrrolidone from 1:1 to 0.2:1, more preferably from 0.8:1 to 0.3:1, most preferably from 0.6:1 to 0.4:1.

These copolymers can be either linear or branched.

The present invention compositions also may employ a polyvinylpyrrolidone ("PVP") having an average molecular weight of from about 5,000 to about 400,000, preferably from about 5,000 to about 200,000, and more preferably from about 5,000 to about 50,000. PVP's are known to persons skilled in the detergent field; see, for example, EP-A-262,897 and EP-A-256,696, incorporated herein by reference.

Compositions containing PVP can also contain polyethylene glycol ("PEG") having an average molecular weight from about 500 to about 100,000, preferably from about 1,000 to about 10,000. Preferably, the ratio of PEG to PVP on a ppm basis delivered in wash solutions is from about 2:1 to about 50:1, and more preferably from about 3:1 to about 10:1.

A mixed polymer system comprising copolymers of (a) N-vinylpyrrolidone and N-vinylimidazole and (b) polyamine N-oxide polymers, particularly poly 4-vinylpyridine N-oxide are a particularly preferred DTI system, particularly preferred in weight ratios of (a):(b) of 5:1 to 1:5. Preferred molecular weights for the DTI essential to the present invention are from 1000 to 250000 Daltons, more preferably from 2000 to 150000 or even from 8000 to 100000 Daltons.

Suitable examples include PVP-K15, PVP-K30, ChromaBond S-400, ChromaBond S-403E and Chromabond S-100 from Ashland Aqualon, and Sokalan® HP165, Sokalan® HP50, Sokalan® HP53, Sokalan® HP59, Sokalan® HP 56K , Sokalan® HP 66 from BASF.

The inventors have found that the compositions comprising optical brightener and DTI provide significant increase in whiteness and this is surprising because typically DTIs reduce the efficacy of optical brighteners.

The dye transfer inhibiting agent may be present at levels from about 0.0001% to about 15%, from about 0.01% to about 10%, preferably from about 0.01% to about 5% by weight of the composition.

Organic Conditioning Oil. The compositions of the present invention may also comprise from about 0.05% to about 3% of at least one organic conditioning oil as the conditioning agent, either alone or in combination with other conditioning agents, such as the silicones (described herein). Suitable conditioning oils include hydrocarbon oils, polyolefins, and fatty esters. Also suitable for use in the compositions herein are the conditioning agents described by the Procter & Gamble Company in U.S. Pat. Nos. 5,674,478, and 5,750,122. Also suitable for use herein are those conditioning agents described in U.S. Pat. Nos. 4,529,586, 4,507,280, 4,663,158, 4,197,865, 4,217, 914, 4,381,919, and 4,422, 853.

Hygiene Agent. The compositions of the present invention may also comprise components to deliver hygiene and/or malodour benefits such as one or more of zinc ricinoleate, thymol, quaternary ammonium salts such as Bardac®, polyethylenimines (such as Lupasol® from BASF) and zinc complexes thereof, silver and silver compounds, especially those designed to slowly release Ag+ or nano-silver dispersions.

Probiotics. The composition may comprise probiotics, such as those described in WO2009/043709.

Suds Boosters. The composition may preferably comprise suds boosters if high sudsing is desired. Suitable examples are the C10-C16 alkanolamides or C10-C14 alkyl sulphates, which are preferably incorporated at 1%-10% levels. The C10-C14 monoethanol and diethanol amides illustrate a typical class of such suds boosters. Use of such suds boosters with high sudsing adjunct surfactants such as the amine oxides, betaines and sultaines noted above is also advantageous. If desired, water-soluble magnesium and/or calcium salts such as MgCl2, MgSO4, CaCl2 , CaSO4 and the like, can be added at levels of, typically, 0.1%-2%, to provide additional suds and to enhance grease removal performance.

Suds Supressor. Compounds for reducing or suppressing the formation of suds may be incorporated into the compositions of the present invention. Suds suppression can be of particular importance in the so-called "high concentration cleaning process" as described in U.S. Pat. No. 4,489,455 and 4,489,574, and in front-loading -style washing machines. A wide variety of materials may be used as suds suppressors, and suds suppressors are well known to those skilled in the art. See, for example, Kirk Othmer Encyclopedia of Chemical Technology, Third Edition, Volume 7, pages 430-447 (John Wiley & Sons, Inc., 1979). Examples of suds supressors include monocarboxylic fatty acid and soluble salts therein, high molecular weight hydrocarbons such as paraffin, fatty acid esters (e.g., fatty acid triglycerides), fatty acid esters of monovalent alcohols, aliphatic C18-C40 ketones (e.g., stearone), N-alkylated amino triazines, waxy hydrocarbons preferably having a melting point below about 100 °C, silicone suds suppressors, and secondary alcohols. Suds supressors are described in U.S. Pat. No. 2,954,347; 4,265,779; 4,265,779; 3,455,839; 3,933,672; 4,652,392; 4,978,471; 4,983,316; 5,288,431;

4,639,489; 4,749,740; and 4,798,679; 4,075,118; European Patent Application No. 89307851.9; EP 150,872; and DOS 2,124,526.

For any detergent compositions to be used in automatic laundry washing machines, suds should not form to the extent that they overflow the washing machine. Suds suppressors, when utilized, are preferably present in a "suds suppressing amount. By "suds suppressing amount" is meant that the formulator of the composition can select an amount of this suds controlling agent that will sufficiently control the suds to result in a low-sudsing laundry detergent for use in automatic laundry washing machines. The compositions herein will generally comprise from 0% to 10% of suds suppressor. When utilized as suds suppressors, monocarboxylic fatty acids, and salts therein, will be present typically in amounts up to 5%, by weight, of the detergent composition. Preferably, from 0.5% to 3% of fatty monocarboxylate suds suppressor is utilized. Silicone suds suppressors are typically utilized in amounts up to 2.0%, by weight, of the detergent composition, although higher amounts may be used. Monostearyl phosphate suds suppressors are generally utilized in amounts ranging from 0.1% to 2%, by weight, of the composition. Hydrocarbon suds suppressors are typically utilized in amounts ranging from 0.01% to 5.0%, although higher levels can be used. The alcohol suds suppressors are typically used at 0.2%-3% by weight of the finished compositions.

Pearlescent Agents. Pearlescent agents as described in WO2011/163457 may be incorporated into the compositions of the invention.

Perfume. Preferably the composition comprises a perfume, preferably in the range from 0.001 to 3wt%, most preferably from 0.1 to 1 wt%. Many suitable examples of perfumes are provided in the CTFA (Cosmetic, Toiletry and Fragrance Association) 1992 International Buyers Guide, published by CFTA Publications and OPD 1993 Chemicals Buyers Directory 80th Annual Edition, published by Schnell Publishing Co. It is usual for a plurality of perfume components to be present in the compositions of the invention, for example four, five, six, seven or more. In perfume mixtures preferably 15 to 25 wt% are top notes. Top notes are defined by Poucher (Journal of the Society of Cosmetic Chemists 6(2):80 [1995]). Preferred top notes include rose oxide, citrus oils, linalyl acetate, lavender, linalool, dihydromyrcenol and cis-3-hexanol.

Packaging. Any conventional packaging may be used and the packaging may be fully or partially transparent so that he consumer can see the colour of the product which may be provided or contributed to by the colour of the dyes essential to the invention. UV absorbing compounds may be included in some or all of the packaging.

Process of Making Compositions

The compositions of the invention may be solid (for example granules or tablets) or liquid form. Preferably the compositions are in liquid form. They may be made by any process chosen by the formulator, non-limiting examples of which are described in the examples and in U.S. 4,990,280; U.S. 20030087791A1; U.S. 20030087790A1; U.S. 20050003983A1; U.S. 20040048764A1; U.S. 4,762,636; U.S. 6,291,412; U.S. 20050227891A1; EP 1070115A2; U.S. 5,879,584; U.S. 5,691,297; U.S. 5,574,005; U.S. 5,569,645; U.S. 5,565,422; U.S. 5,516,448; U.S. 5,489,392; U.S. 5,486.

When in the form of a liquid, the compositions of the invention may be aqueous (typically above 2 wt% or even above 5 or 10 wt% total water, up to 90 or up to 80wt% or 70 wt% total water) or non-aqueous (typically below 2 wt% total water content). Typically the compositions of the invention will be in the form of an aqueous liquor or uniform dispersion or suspension of optical brightener, DTI and optional additional adjunct materials, some of which may normally be in solid form, that have been combined with the normally liquid components of the composition, such as the liquid alcohol ethoxylate nonionic, the aqueous liquid carrier, and any other normally liquid optional ingredients. Such a solution, dispersion or suspension will be acceptably phase stable. When in the form of a liquid, the detergents of the invention preferably have viscosity from 1 to 1500 centipoises (1-1500 mPa*s), more preferably from 100 to 1000 centipoises (100-1000 mPa*s), and most preferably from 200 to 500 centipoises (200-500 mPa*s) at 20s-1 and 21°C. Viscosity can be determined by conventional methods. Viscosity may be measured using an AR 550 rheometer from TA instruments using a plate steel spindle at 40 mm diameter and a gap size of 500 µm. The high shear viscosity at 20s-1 and low shear viscosity at 0.05-1 can be obtained from a logarithmic shear rate sweep from 0.1-1 to 25-1 in 3 minutes time at 21C. The preferred rheology described therein may be achieved using internal existing structuring with detergent ingredients or by employing an external rheology modifier. More preferably the detergents, such as detergent liquid compositions have a high shear rate viscosity of from about 100 centipoise to 1500 centipoise, more preferably from 100 to 1000 cps. Unit Dose detergents, such as detergent liquid compositions have high shear rate viscosity of from 400 to 1000cps. Detergents such as laundry softening compositions typically have high shear rate viscosity of from 10 to 1000, more preferably from 10 to 800 cps, most preferably from 10 to 500 cps. Hand dishwashing compositions have high shear rate viscosity of from 300 to 4000 cps, more preferably 300 to 1000 cps.

The cleaning and/or treatment compositions in the form of a liquid herein can be prepared by combining the components thereof in any convenient order and by mixing, e.g., agitating, the resulting component combination to form a phase stable liquid detergent composition. In a process for preparing such compositions, a liquid matrix is formed containing at least a major proportion, or even substantially all, of the liquid components, e.g., nonionic surfactant, the non-surface active liquid carriers and other optional liquid components, with the liquid components being thoroughly admixed by imparting shear agitation to this liquid combination. For example, rapid stirring with a mechanical stirrer may usefully be employed. While shear agitation is maintained, substantially all of any anionic surfactants and the solid form ingredients can be added. Agitation of the mixture is continued, and if necessary, can be increased at this point to form a solution or a uniform dispersion of insoluble solid phase particulates within the liquid phase. After some or all of the solid-form materials have been added to this agitated mixture, particles of any enzyme material to be included, e.g., enzyme prills, are incorporated. As a variation of the composition preparation procedure hereinbefore described, one or more of the solid components may be added to the agitated mixture as a solution or slurry of particles premixed with a minor portion of one or more of the liquid components. After addition of all of the composition components, agitation of the mixture is continued for a period of time sufficient to form compositions having the requisite viscosity and phase stability characteristics. Frequently this will involve agitation for a period of from about 30 to 60 minutes.

Pouches. In a preferred embodiment of the invention, the composition is provided in the form of a unitized dose, either tablet form or preferably in the form of a liquid/solid (optionally granules)/gel/paste held within a water-soluble film in what is known as a pouch or pod. The composition can be encapsulated in a single or multi-compartment pouch. Multi-compartment pouches are described in more detail in EP-A-2133410.

Suitable film for forming the pouches is soluble or dispersible in water, and preferably has a water-solubility/dispersibility of at least 50%, preferably at least 75% or even at least 95%, as measured by the method set out here after using a glass-filter with a maximum pore size of 20 microns:

50 grams ± 0.1 gram of pouch material is added in a pre-weighed 400 ml beaker and 245ml ± 1ml of distilled water is added. This is stirred vigorously on a magnetic stirrer set at 600 rpm, for 30 minutes. Then, the mixture is filtered through a folded qualitative sintered-glass filter with a pore size as defined above (max. 20 micron). The water is dried off from the collected filtrate by any conventional method, and the weight of the remaining material is determined (which is the dissolved or dispersed fraction). Then, the percentage solubility or dispersability can be calculated. Preferred film materials are polymeric materials. The film material can be obtained, for example, by casting, blow-moulding, extrusion or blown extrusion

of the polymeric material, as known in the art. Preferred polymers, copolymers or derivatives thereof suitable for use as pouch material are selected from polyvinyl alcohols, polyvinyl pyrrolidone, polyalkylene oxides, acrylamide, acrylic acid, cellulose, cellulose ethers, cellulose esters, cellulose amides, polyvinyl acetates, polycarboxylic acids and salts, polyaminoacids or peptides, polyamides, polyacrylamide, copolymers of maleic/acrylic acids, polysaccharides including starch and gelatine, natural gums such as xanthum and carragum. More preferred polymers are selected from polyacrylates and water-soluble acrylate copolymers, methylcellulose, carboxymethylcellulose sodium, dextrin, ethylcellulose, hydroxyethyl cellulose, hydroxypropyl methylcellulose, maltodextrin, polymethacrylates, and most preferably selected from polyvinyl alcohols, polyvinyl alcohol copolymers and hydroxypropyl methyl cellulose (HPMC), and combinations thereof. Preferably, the level of polymer in the pouch material, for example a PVA polymer, is at least 60%. The polymer can have any weight average molecular weight, preferably from about 1000 to 1,000,000, more preferably from about 10,000 to 300,000 yet more preferably from about 20,000 to 150,000. Mixtures of polymers can also be used as the pouch material. This can be beneficial to control the mechanical and/or dissolution properties of the compartments or pouch, depending on the application thereof and the required needs. Suitable mixtures include for example mixtures wherein one polymer has a higher water-solubility than another polymer, and/or one polymer has a higher mechanical strength than another polymer. Also suitable are mixtures of polymers having different weight average molecular weights, for example a mixture of PVA or a copolymer thereof of a weight average molecular weight of about 10,000- 40,000, preferably around 20,000, and of PVA or copolymer thereof, with a weight average molecular weight of about 100,000 to 300,000, preferably around 150,000. Also suitable herein are polymer blend compositions, for example comprising hydrolytically degradable and water-soluble polymer blends such as polylactide and polyvinyl alcohol, obtained by mixing polylactide and polyvinyl alcohol, typically comprising about 1-35% by weight polylactide and about 65% to 99% by weight polyvinyl alcohol. Preferred for use herein are polymers which are from about 60% to about 98% hydrolysed, preferably about 80% to about 90% hydrolysed, to improve the dissolution characteristics of the material.

Naturally, different film material and/or films of different thickness may be employed in making the compartments of the present invention. A benefit in selecting different films is that the resulting compartments may exhibit different solubility or release characteristics.

Most preferred film materials are PVA films known under the MonoSol trade reference M8630, M8900, H8779 (as described in the Applicants co-pending applications ref 44528 and

11599) and those described in US 6 166 117 and US 6 787 512 and PVA films of corresponding solubility and deformability characteristics.

The film material herein can also comprise one or more additive ingredients. For example, it can be beneficial to add plasticisers, for example glycerol, ethylene glycol, diethyleneglycol, propylene glycol, sorbitol and mixtures thereof. Other additives include functional detergent additives to be delivered to the wash water, for example organic polymeric dispersants, etc.

Bittering agent may be incorporated into a pouch or pod, either by incorporation in the composition inside the pouch, and/or by coating onto the film.

Process for Making the Water-Soluble Pouch

The compositions of the invention in pouch form may be made using any suitable equipment and method. However the multi-compartment pouches are preferably made using the horizontal form filling process. The film is preferably wetting, more preferably heated to increase the malleability thereof. Even more preferably, the method also involves the use of a vacuum to draw the film into a suitable mould. The vacuum drawing the film into the mould can be applied for 0.2 to 5 seconds, preferably 0.3 to 3 or even more preferably 0.5 to 1.5 seconds, once the film is on the horizontal portion of the surface. This vacuum may preferably be such that it provides an under-pressure of between -100mbar to -1000mbar, or even from -200mbar to -600mbar.

The moulds, in which the pouches are made, can have any shape, length, width and depth, depending on the required dimensions of the pouches. The moulds can also vary in size and shape from one to another, if desirable. For example, it may be preferred that the volume of the final pouches is between 5 and 300ml, or even 10 and 150ml or even 20 and 100ml and that the mould sizes are adjusted accordingly.

Heat can be applied to the film, in the process commonly known as thermoforming, by any means. For example the film may be heated directly by passing it under a heating element or through hot air, prior to feeding it onto the surface or once on the surface. Alternatively it may be heated indirectly, for example by heating the surface or applying a hot item onto the film. Most preferably the film is heated using an infra red light. The film is preferably heated to a temperature of 50 to 120°C, or even 60 to 90°C. Alternatively, the film can be wetted by any mean, for example directly by spraying a wetting agent (including water, solutions of the film material or plasticizers for the film material) onto the film, prior to feeding it onto the surface or once on the surface, or indirectly by wetting the surface or by applying a wet item onto the film.

In the case of pouches comprising powders it is advantageous to pin prick the film for a number of reasons: (a) to reduce the possibility of film defects during the pouch formation, for example film defects giving rise to rupture of the film can be generated if the stretching of the film is too fast; (b) to permit the release of any gases derived from the product enclosed in the pouch, as for example oxygen formation in the case of powders containing bleach; and/or (c) to allow the continuous release of perfume. Moreover, when heat and/or wetting is used, pin pricking can be used before, during or after the use of the vacuum, preferably during or before application of the vacuum. Preferred is thus that each mould comprises one or more holes which are connected to a system which can provide a vacuum through these holes, onto the film adjacent the holes.

Once a film has been heated/wetted, it is drawn into an appropriate mould, preferably using a vacuum. The filling of the moulded film can be done by any known method for filling (moving) items. The most preferred method will depend on the product form and speed of filling required. Preferably the moulded film is filled by in-line filling techniques. The filled, open pouches are then closed, using a second film, by any suitable method. Preferably, this is also done while in horizontal position and in continuous, constant motion. Preferably the closing is done by continuously feeding a second material or film, preferably water-soluble film, over and onto the web of open pouches and then preferably sealing the first film and second film together, typically in the area between the moulds and thus between the pouches.

Preferred methods of sealing include heat sealing, solvent welding, and solvent or wet sealing. It is preferred that only the area which is to form the seal, is treated with heat or solvent. The heat or solvent can be applied by any method, preferably on the closing material, preferably only on the areas which are to form the seal. If solvent or wet sealing or welding is used, it may be preferred that heat is also applied. Preferred wet or solvent sealing/ welding methods include applying selectively solvent onto the area between the moulds, or on the closing material, by for example, spraying or printing this onto these areas, and then applying pressure onto these areas, to form the seal. Sealing rolls and belts as described above (optionally also providing heat) can be used, for example.

The formed pouches can then be cut by a cutting device. Cutting can be done using any known method. It may be preferred that the cutting is also done in continuous manner, and preferably with constant speed and preferably while in horizontal position. The cutting device can, for example, be a sharp item or a hot item, whereby in the latter case, the hot item ‘burns’ through the film/ sealing area.

The different compartments of a multi-compartment pouch may be made together in a side-by-side style and consecutive pouches are not cut. Alternatively, the compartments can be made separately. According to this process and preferred arrangement, the pouches are made according to the process comprising the steps of:

a) forming an first compartment (as described above);

b) forming a recess within some or all of the closed compartment formed in step (a), to generate a second moulded compartment superposed above the first compartment;

c) filling and closing the second compartments by means of a third film;

d) sealing said first, second and third films; and

e) cutting the films to produce a multi-compartment pouch.

Said recess formed in step b is preferably achieved by applying a vacuum to the compartment prepared in step a).

Alternatively the second, and optionally third, compartment(s) can be made in a separate step and then combined with the first compartment as described in our co-pending application EP 08101442.5 which is incorporated herein by reference. A particularly preferred process comprises the steps of:

a) forming a first compartment, optionally using heat and/or vacuum, using a first film on a first forming machine;

b) filling said first compartment with a first composition;

c) on a second forming machine, deforming a second film, optionally using heat and vacuum, to make a second and optionally third moulded compartment;

d) filling the second and optionally third compartments;

e) sealing the second and optionally third compartment using a third film;

f) placing the sealed second and optionally third compartments onto the first compartment;

g) sealing the first, second and optionally third compartments; and

h) cutting the films to produce a multi-compartment pouch

The first and second forming machines are selected based on their suitability to perform the above process. The first forming machine is preferably a horizontal forming machine. The second forming machine is preferably a rotary drum forming machine, preferably located above the first forming machine.

It will be understood moreover that by the use of appropriate feed stations, it is possible to manufacture multi-compartment pouches incorporating a number of different or distinctive compositions and/or different or distinctive liquid, gel or paste compositions.

Method of Use. The compositions of this invention, typically prepared as hereinbefore described, can be used to form aqueous washing/treatment solutions for use in the laundering/treatment of fabrics. Generally, an effective amount of such a composition is added to water, for example in a conventional fabric automatic washing machine, to form such aqueous laundering solutions. The aqueous washing solution so formed is then contacted, typically under agitation, with the fabrics to be laundered/treated therewith. An effective amount of the detergent composition herein added to water to form aqueous laundering solutions can comprise amounts sufficient to form from about 500 to 25,000 ppm, or from 500 to 15,000 ppm of composition in aqueous washing solution, or from about 1,000 to 3,000 ppm of the detergent compositions herein will be provided in aqueous washing solution.

Typically, the wash liquor is formed by contacting the detergent with wash water in such an amount so that the concentration of the detergent in the wash liquor is from above 0g/l to 5g/l, or from 1g/l, and to 4.5g/l, or to 4.0g/l, or to 3.5g/l, or to 3.0g/l, or to 2.5g/l, or even to 2.0g/l, or even to 1.5g/l. The method of laundering fabric or textile may be carried out in a top-loading or front-loading automatic washing machine, or can be used in a hand-wash laundry application. In these applications, the wash liquor formed and concentration of laundry detergent composition in the wash liquor is that of the main wash cycle. Any input of water during any optional rinsing step(s) is not included when determining the volume of the wash liquor.

The wash liquor may comprise 40 litres or less of water, or 30 litres or less, or 20 litres or less, or 10 litres or less, or 8 litres or less, or even 6 litres or less of water. The wash liquor may comprise from above 0 to 15 litres, or from 2 litres, and to 12 litres, or even to 8 litres of water. Typically from 0.01kg to 2kg of fabric per litre of wash liquor is dosed into said wash liquor. Typically from 0.01kg, or from 0.05kg, or from 0.07kg, or from 0.10kg, or from 0.15kg, or from 0.20kg, or from 0.25kg fabric per litre of wash liquor is dosed into said wash liquor. Optionally, 50g or less, or 45g or less, or 40g or less, or 35g or less, or 30g or less, or 25g or less, or 20g or less, or even 15g or less, or even 10g or less of the composition is contacted to water to form the wash liquor. Such compositions are typically employed at concentrations of from about 500 ppm to about 15,000 ppm in solution. When the wash solvent is water, the water temperature typically ranges from about 5 °C to about 90 °C and, when the situs comprises a fabric, the water to fabric ratio is typically from about 1:1 to about 30:1. Typically the wash liquor comprising the detergent of the invention has a pH of from 3 to 11.5.

In one aspect, such method comprises the steps of optionally washing and/or rinsing said surface or fabric, contacting said surface or fabric with any composition disclosed in this specification then optionally washing and/or rinsing said surface or fabric is disclosed, with an optional drying step.

Drying of such surfaces or fabrics may be accomplished by any one of the common means employed either in domestic or industrial settings: machine drying or open-air drying. The fabric may comprise any fabric capable of being laundered in normal consumer or institutional use conditions, and the invention is particularly suitable for synthetic textiles such as polyester and nylon and especially for treatment of mixed fabrics and/or fibres comprising synthetic and cellulosic fabrics and/or fibres. As examples of synthetic fabrics are polyester, nylon, these may be present in mixtures with cellulosic fibres, for example, polycotton fabrics. The solution typically has a pH of from 7 to 11, more usually 8 to 10.5. The compositions are typically employed at concentrations from 500 ppm to 5,000 ppm in solution. The water temperatures typically range from about 5 °C to about 90 °C. The water to fabric ratio is typically from about 1:1 to about 30:1.

The ingredients in the compositions of this invention may be incorporated into the composition as the product of the synthesis generating such components, either with or without an intermediate purification step. Where there is no purification step, commonly the mixture used will comprise the desired component or mixtures thereof (and percentages given herein relate to the weight percent of the component itself unless otherwise specified) and in addition unreacted starting materials and impurities formed from side reactions and/or incomplete reaction. For example, for an ethoxylated or substituted component, the mixture will likely comprise different degrees of ethoxylation/substitution.

EXAMPLES

Example 1

In order to illustrate the increase of deposition of a nuclease enzyme on a hydrophobised surface, the following experiment was carried out: using a Dual Polarized Interferometer (Farfield Analight Bio200) we recorded the deposition of the nuclease (SEQ ID NO 1) on two model surfaces. First a neat quartz hydrophilic surface: An Anachip^{TM} chip from Farfield was treated by exposing it to UV light for 30 minutes using a UV/Ozone Procleaner^{TM} (Bioforce Nanosciences). The surface is then highly hydrophilic.

A second surface was hydrophobically modified: A UV-O3 treated Anachip^{TM} was dipped in a 1% solution (Chloromethyl)trimethylsilane (Sigma Aldrich) in toluene for 30 seconds and rinsed with ethanol. This method grafts silane on the silica surface increasing the concentration of methyl groups on the surface, thus rendering it hydrophobic.

The treated chips were then placed in the DPI instrument and put in contact with a flow of deionised water to measure a baseline signal, once the initial signal is stable a solution of 2.6% in mass nuclease in deionised water is then injected and once the signal is stabilized, the surface was rinsed with de-ionised (DI) water. DPI measures the changes in refractive index on the surface, the difference between the pure DI water signal and the signal after the final rinse indicates nuclease retention. On the hydrophilic surface, the signal rose after the injection, due to the nuclease flowing above the surface. However, the change was modest, showing the minimal interaction of the nuclease with the surface. After rinsing with DI water the signal rapidly returned to the baseline, evidence that the nuclease has not deposited on the hydrophilic surface.

In the case of the hydrophobically modified surface, the signal raised considerably more after injection and took longer to stabilize compared to the hydrophilic surface.

This indicates that the nuclease is depositing onto the surface and increasing coverage over time. After rinse, the signal remains higher than the DI water baseline due to retention of nuclease on the surface.

This experiment shows that the nuclease according to SEQ ID NO1 is retained on hydrophobic surfaces much more effectively than on hydrophilic surfaces.

The following Formulation Examples illustrate cleaning compositions suitable for forming the aqueous liquor.

Formulation Examples

Examples 1-7 Heavy Duty Liquid laundry detergent compositions

Ingredients	**1**	**2**	**3**	**4**	**5**	**6**	**7**
	% weight						
$AE_{1.8}S$	11.00	10.00	4.00	6.30	-	-	-
AE_3S	-	-	-	-	2.40	-	-
LAS	1.40	4.00	8.00	3.30	5.00	8.00	19.00
HSAS	3.00	5.10	3.00	-	-	-	-
AE9	0.4	0.6	0.3	0.3	-	-	-
AE8	-	-	-	-	-	-	20.00
AE7	-	-	-	-	2.40	6.00	-
C_{12-14} dimethyl Amine Oxide	0.30	0.73	0.23	0.37	-	-	-
C_{12-18} Fatty Acid	0.80	1.90	0.60	0.99	1.20	-	15.00

Citric Acid	2.50	3.96	1.88	1.98	0.90	2.50	0.60
Optical Brightener 1	1.00	0.80	0.10	0.30	0.05	0.50	0.001
Optical Brightener 3	0.001	0.05	0.01	0.20	0.50	-	1.00
Sodium formate	1.60	0.09	1.20	0.04	1.60	1.20	0.20
DTI 1	0.32	0.05	-	0.60	0.10	0.60	0.01
DTI 2	0.32	0.10	0.60	0.60	0.05	0.40	0.20
Sodium hydroxide	2.30	3.80	1.70	1.90	1.70	2.50	2.30
Monoethanolamine	1.40	1.49	1.00	0.70	-	-	-
Diethylene glycol	5.50	-	4.10	-	-	-	-
Chelant 1	0.15	0.15	0.11	0.07	0.50	0.11	0.80
4-formyl-phenylboronic acid	-	-	-	-	0.05	0.02	0.01
Sodium tetraborate	1.43	1.50	1.10	0.75	-	1.07	-
Ethanol	1.54	1.77	1.15	0.89	-	3.00	7.00
Polymer 1	0.10	-	-	-	-	-	2.00
Polymer 2	0.30	0.33	0.23	0.17	-	-	-
Polymer 3	-	-	-	-	-	-	0.80
Polymer 4	0.80	0.81	0.60	0.40	1.00	1.00	-
1,2-Propanediol	-	6.60	-	3.30	0.50	2.00	8.00
Structurant	0.10	-	-	-	-	-	0.10
Perfume	1.60	1.10	1.00	0.80	0.90	1.50	1.60
Perfume encapsulate	0.10	0.05	0.01	0.02	0.10	0.05	0.10
Protease	0.80	0.60	0.70	0.90	0.70	0.60	1.50
Mannanase	0.07	0.05	0.045	0.06	0.04	0.045	0.10
Amylase 1	0.30	-	0.30	0.10	-	0.40	0.10
Amylase 2	-	0.20	0.10	0.15	0.07	-	0.10
Xyloglucannase	0.20	0.10	-	-	0.05	0.05	0.20
Lipase	0.40	0.20	0.30	0.10	0.20	-	-
Polishing enzyme	-	0.04	-	-	-	0.004	-
Nuclease (SEQ ID NO 1, 100% active)	0.05	0.03	0.01	0.03	0.03	0.003	0.003
Dispersin B	-	-	-	0.05	0.03	0.001	0.001
Acid Violet 50	0.05	-	-	-	-	-	0.005

Direct Violet 9	-	-	-	-	-	0.05	-
Violet DD	-	0.035	0.02	0.037	0.04	-	-
Water, dyes & minors	Balance						
pH	8.2						

Based on total cleaning and/or treatment composition weight. Enzyme levels are reported as raw material.

Examples 8 to 16 Unit Dose Compositions

These examples provide various formulations for unit dose laundry detergents. Compositions 8 to 12 comprise a single unit dose compartment. The film used to encapsulate the compositions in PVA.

Ingredients	**8**	**9**	**10**	**11**	**12**
	% weight				
LAS	14.5	14.5	14.5	14.5	14.5
AE3S	7.5	7.5	7.5	7.5	7.5
AE7	13.0	13.0	13.0	13.0	13.0
Citric Acid	0.6	0.6	0.6	0.6	0.6
C12-15 Fatty Acid	14.8	14.8	14.8	14.8	14.8
Polymer 3	4.0	4.0	4.0	4.0	4.0
Chelant 2	1.2	1.2	1.2	1.2	1.2
Optical Brightener 1	0.20	0.25	0.01	0.01	0.50
Optical Brightener 2	0.20	-	0.25	0.03	0.01
Optical Brightener 3	0.18	0.09	0.30	0.01	-
DTI 1	0.10	-	0.20	0.01	0.05
DTI 2	-	0.10	0.20	0.25	0.05
Glycerol	6.1	6.1	6.1	6.1	6.1
Monoethanol amine	8.0	8.0	8.0	8.0	8.0
Tri-isopropanol amine	-	-	2.0	-	-
Tri-ethanol amine	-	2.0	-	-	-
Cumene sulphonate	-	-	-	-	2.0
Protease	0.80	0.60	0.07	1.00	1.50

Mannanase	0.07	0.05	0.05	0.10	0.01
Amylase 1	0.20	0.11	0.30	0.50	0.05
Amylase 2	0.11	0.20	0.10	-	0.50
Polishing enzyme	0.005	0.05	-	-	-
Nuclease	0.005	0.05	0.005	0.010	0.005
Dispersin B	0.010	0.05	0.005	0.005	-
cyclohexyl dimethanol	-	-	-	2.0	-
Acid violet 50	0.03	0.02			
Violet DD			0.01	0.05	0.02
Structurant	0.14	0.14	0.14	0.14	0.14
Perfume	1.9	1.9	1.9	1.9	1.9
Water and miscellaneous	To 100%				
pH	7.5-8.2				

Based on total cleaning and/or treatment composition weight. Enzyme levels are reported as raw material.

In the following examples the unit dose has three compartments, but similar compositions can be made with two, four or five compartments. The film used to encapsulate the compartments is polyvinyl alcohol.

Base compositions	**13**	**14**	**15**	**16**
Ingredients	**% weight**			
HLAS	24.6	18.4	17.0	14.8
AE7	20.1	14.3	13.0	18.6
Citric Acid	0.5	0.7	0.6	0.5
C12-15 Fatty acid	16.4	6.0	11.0	13.0
Polymer 1	2.9	0.1	-	-
Polymer 3	1.1	5.1	2.5	4.2
Cationic cellulose polymer	-	-	0.3	0.5
Random graft copolymer	-	1.5	0.3	0.2
Chelant 2	1.1	2.0	0.6	1.5
Optical Brightener 1	0.20	0.25	0.01	0.005
Optical Brightener 3	0.18	0.09	0.30	0.005

DTI 1	0.1	-	0.2	-
DTI 2	-	0.1	0.2	-
Glycerol	5.3	5.0	5.0	4.2
Monoethanolamine	10.0	8.1	8.4	7.6
Polyethylene glycol	-	-	2.5	3.0
Potassium sulfite	0.2	0.3	0.5	0.7
Protease	0.80	0.60	0.40	0.80
Amylase 1	0.20	0.20	0.200	0.30
Polishing enzyme	-	-	0.005	0.005
Nuclease	0.05	0.010	0.005	0.005
Dispersin B	-	0.010	0.010	0.010
$MgCl_2$	0.2	0.2	0.1	0.3
Structurant	0.2	0.1	0.2	0.2
Acid Violet 50	0.04	0.03	0.05	0.03
Perfume / encapsulates	0.10	0.30	0.01	0.05
*Solvents and misc.	To 100%			
pH	7.0-8.2			

Unit Dose Compositions	**17**			**18**		
Compartment	A	B	C	A	B	C
Volume of each compartment	40 ml	5 ml	5 ml	40 ml	5 ml	5 ml
Ingredients	Active material in Wt.%					
Perfume	1.6	1.6	1.6	1.6	1.6	1.6
Violet DD	0	0.006	0	0	0.004	-
TiO2	-	-	0.1	-		0.1
Sodium Sulfite	0.4	0.4	0.4	0.3	0.3	0.3
Polymer 5	-			2	-	-
Hydrogenated castor oil	0.14	0.14	0.14	0.14	0.14	0.14
Base Composition 13, 14, 15 or 16	Add to 100%					

Based on total cleaning and/or treatment composition weight, enzyme levels are reported as raw material.

Examples 19 to 24: Granular laundry detergent compositions for hand washing or washing machines, typically top-loading washing machines.

Ingredient	**19**	**20**	**21**	**22**	**23**	**24**
	% weight					
LAS	20	22	20	15	19.5	20
Quaternary ammonium	0.7	0.2	1.0	0.6	-	-
AE3S	0.9	1.0	0.9	-	0.4	0.9
AE7	-	-	-	1.0	0.1	3.0
Sodium Tripolyphosphate	5.0	-	4.0	9.0	2.0	-
Zeolite A	-	1.0	-	1.0	4.0	1.0
Sodium silicate 1.6R	7.0	5.0	2.0	3.0	3.0	5.0
Sodium carbonate	20.0	17.0	23.0	14.0	14.0	16.0
Polyacrylate MW 4500	1.0	0.6	1.0	1.0	1.5	1.0
Random graft copolymer	0.1	0.2	-	-	0.1	-
Carboxymethyl cellulose	1.0	0.3	1.0	1.0	1.0	1.0
Acid Violet 50	0.05	-	0.02	-	0.04	-
Violet DD	-	0.03	-	0.03	-	0.03
Protease 2	0.10	0.10	0.10	0.10	-	0.10
Amylase	0.03	-	0.03	0.03	0.03	0.03
Lipase	0.03	0.07	0.30	0.10	0.07	0.40
Polishing enzyme	0.002	-	0.05	-	0.02	-
Nuclease	0.001	0.001	0.01	0.05	0.002	0.02
Dispersin B	0.001	0.001	0.05	-	0.001	-
Optical Brightener 1	0.200	0.001	0.300	0.650	0.050	0.001
Optical Brightener 2	0.060	-	0.650	0.180	0.200	0.060
Optical Brightener 3	0.100	0.060	0.050	-	0.030	0.300
Chelant 1	0.60	0.80	0.60	0.25	0.60	0.60
DTI 1	0.32	0.15	0.15	-	0.10	0.10
DTI 2	0.32	0.15	0.30	0.30	0.10	0.20
Sodium Percarbonate	-	5.2	0.1	-	-	-
Sodium Perborate	4.4	-	3.85	2.09	0.78	3.63

Nonanoyloxy benzensulphonate	1.9	0.0	1.66	0.0	0.33	0.75
Tetraacetylethylenediamine	0.58	1.2	0.51	0.0	0.015	0.28
Photobleach	0.0030	0.0	0.0012	0.0030	0.0021	-
S-ACMC	0.1	0.0	0.0	0.0	0.06	0.0
Sulfate/Moisture	Balance					

Examples 25-37

Granular laundry detergent compositions typically for front-loading automatic washing machines.

Ingredient	**25**	**26**	**27**	**28**	**29**	**30**
	% weight					
LAS	8.0	7.1	7.0	6.5	7.5	7.5
AE3S	-	4.8	1.0	5.2	4.0	4.0
AS	1.0	-	1.0	-	-	-
AE7	2.2	-	2.2	-	-	-
Quaternary ammonium	0.75	0.94	0.98	0.98	-	-
Crystalline layered silicate	4.1	-	4.8	-	-	-
Zeolite A	5.0	-	2.0	-	2.0	2.0
Citric acid	3.0	4.0	3.0	4.0	2.5	3.0
Sodium carbonate	11.0	17.0	12.0	15.0	18.0	18.0
Sodium silicate 2R	0.08	-	0.11	-	-	-
Optical Brightener 1	-	0.25	0.05	0.01	0.10	0.02
Optical Brightener 2	-	-	0.25	0.20	0.01	0.08
Optical Brightener 3	-	0.06	0.04	0.15	-	0.05
DTI 1	0.08	-	0.04	-	0.10	0.01
DTI 2	0.08	-	0.04	0.10	0.10	0.02
Soil release agent	0.75	0.72	0.71	0.72	-	-
Acrylic /maleic acid copolymer	1.1	3.7	1.0	3.7	2.6	3.8
Carboxymethyl cellulose	0.2	1.4	0.2	1.4	1.0	0.5
Protease 3	0.20	0.20	0.30	0.15	0.12	0.13
Amylase 3	0.20	0.15	0.20	0.30	0.15	0.15
Lipase	0.05	0.15	0.10	-	-	-

Amylase 2	0.03	0.07	-	-	0.05	0.05
Cellulase 2	-	-	-	-	0.10	0.10
Polishing enzyme	0.003	0.005	0.020	-	-	-
Nuclease	0.002	0.010	0.020	0.020	0.010	0.003
Dispersin B	0.002	0.010	0.020	0.020	0.010	0.002
Tetraacetylethylenediamine	3.6	4.0	3.6	4.0	2.2	1.4
Sodium percarbonate	13.0	13.2	13.0	13.2	16.0	14.0
Chelant 3	-	0.2	-	0.2	-	0.2
Chelant 2	0.2	-	0.2	-	0.2	0.2
$MgSO_4$	-	0.42	-	0.42	-	0.4
Perfume	0.5	0.6	0.5	0.6	0.6	0.6
Suds suppressor agglomerate	0.05	0.10	0.05	0.10	0.06	0.05
Soap	0.45	0.45	0.45	0.45	-	-
Acid Violet 50	0.04	-	0.05	-	0.04	-
Violet DD	-	0.04	-	0.05	-	0.04
S-ACMC	0.01	0.01	-	0.01	-	-
Direct Violet 9 (active)	-	-	0.0001	0.0001	-	-
Sulfate/ Water & Miscellaneous	Balance					

AE1.8S	is C_{12-15} alkyl ethoxy (1.8) sulfate
AE3S	is C_{12-15} alkyl ethoxy (3) sulfate
AE7	is C_{12-13} alcohol ethoxylate, with an average degree of ethoxylation of 7
AE8	is C_{12-13} alcohol ethoxylate, with an average degree of ethoxylation of 8
AE9	is C_{12-13} alcohol ethoxylate, with an average degree of ethoxylation of 9
Amylase 1	Stainzyme®, 15 mg active/g
Amylase 2	Natalase®, 29 mg active/g
Amylase 3	Stainzyme Plus®, 20 mg active/g,
AS	is C_{12-14} alkylsulfate

Cellulase 2	Celluclean^{TM} , 15.6 mg active/g
Xyloglucanase,	Whitezyme®, 20mg active/g
Chelant 1	diethylene triamine pentaacetic acid
Chelant 2	1-hydroxyethane 1,1-diphosphonic acid
Chelant 3	Na salt of Ethylenediamine-N,N'-disuccinic acid, (S,S) isomer (EDDS)
Dispersin B	Glycosidase hydrolase, reported as 1000mg active/g
DTI 1	is poly(4-vinylpyridine-1-oxide) (such as Chromabond S-403E®),
DTI 2	is poly(1-vinylpyrrolidone-co-1-vinylimidazole) (such as Sokalan HP56®).
HSAS	is mid-branched alkyl sulfate as disclosed in US 6,020,303 and US6,060,443
LAS	is linear alkylbenzenesulfonate having an average aliphatic carbon chain length C_9-C_{15} (HLAS is acid form).
Lipase	Lipex®, 18 mg active/g
Mannanase	Mannaway®, 25 mg active/g
Nuclease	phosphodiesterase SEQ ID NO 1, reported as 1000mg active/g
Optical Brightener 1	is disodium 4,4'-bis{[4-anilino-6-morpholino-s-triazin-2-yl]-amino}-2,2'-stilbenedisulfonate
Optical Brightener 2	is disodium 4,4'-bis-(2-sulfostyryl)biphenyl (sodium salt)
Optical Brightener 3	is Optiblanc SPL10® from 3V Sigma
Perfume encapsulate:	is a Core –shell melamine formaldehyde perfume microcapsules.
Photobleach	Sulphonated zinc phthalocyanine
Polishing enzyme	Paranitrobenzyl esterates, reported as 1000mg active/g
Polymer 1	bis((C_2H_5O)(C_2H_4O)n)(CH_3)-N^+-C_xH_{2x}-N^+-(CH_3)-bis((C_2H_5O)(C_2H_4O)n), wherein n = 20-30,x = 3 to 8 or sulphated or sulphonated variants thereof
Polymer 2	Ethoxylated (EO_{15}) tetraethylene pentamine
Polymer 3	Ethoxylated Polyethylenimine
Polymer 4	Ethoxylated hexamethylene diamine
Polymer 5	Acusol 305, Rohm&Haas

Protease	Purafect Prime®, 40.6 mg active/g
Protease 2	Savinase®, 32.89 mg active/g
Protease 3	Purafect®, 84 mg active/g
Quaternary ammonium	is C_{12-14} Dimethylhydroxyethyl ammonium chloride
S-ACMC	Reactive Blue 19 Azo-CM-Cellulose provided by Megazyme
Structurant	Hydrogenated Castor Oil

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

CLAIMS

What is claimed is:

1. A method of treating a fabric, comprising
   - (i) contacting the fabric with an aqueous liquor comprising a fabric care component selected from the group consisting of cationic softening-compounds, silicone softening-compounds, paraffins, waxes, dispersible polyolefins and mixtures thereof; and
   - (ii) contacting the fabric with an aqueous liquor comprising a nuclease enzyme, preferably a deoxyribonuclease or ribonuclease enzyme.
2. A method according to claim 1 wherein the fabric care component comprises a cationic softening compound and/or a silicone softening-compound.
3. A method according to claim 1 or claim 2 wherein the fabric care component is selected from quaternary ammonium compounds, preferably ester quaternary ammonium compounds, and mixtures thereof.
4. A method according to any preceding claim wherein the amount of fabric care component active present in the aqueous liquor is from 0.005 to 2g/l..
5. A method according to any preceding claim wherein steps (i) and (ii) are sequential.
6. A method according to any of claims 1 to 4 wherein steps (i) and (ii) are simultaneous and preferably the amount of fabric care component active present in the aqueous liquor is from 0.005 to 2g/l..
7. A method according to any preceding claim wherein step (i) comprises a rinse step in a laundering process.
8. A method according to any of claims 1 to 5 wherein step (ii) comprises a laundering step.
9. A method according to any preceding claim wherein the fabric comprises cellulosic substrates, preferably comprising a cotton single or blended textile.
10. A method according to any preceding claim wherein the aqueous liquor comprises from 0.01ppm to 1000 ppm of the nuclease enzyme.
11. A method according to any preceding claim wherein the enzyme is selected from the nucleases of any of E.C. classes E.C. 3.1.21.x (where x=1, 2, 3, 4, 5, 6, 7, 8, 9), 3.1.22.y (where y=1, 2, 3, 4, 5), E.C. 3.1.30.z (where z=1, 2) or E.C. 3.1.31.1, or mixtures thereof, preferably comprising a deoxyribonuclease from E.C. 3.1.21.1, preferably wherein the enzyme has an amino acid sequence with at least 85 or 90 or 95% or even 100% identity with any of the amino acid sequences shown in SEQ ID NO:1.

12. A method according to claim 14 wherein the enzyme comprises an enzyme having both RNase and DNase activity, preferably being from E.C. 3.1.30.2.
13. A method according to any preceding claim wherein the enzyme is a microbial, preferably a bacterial enzyme.
14. A method according to any preceding claim wherein the fabric in step (ii) is contacted with a laundry detergent composition in a wash cycle of an automatic washing machine and wherein the length of the wash cycle is at 3 minutes, or even at least 6 minutes, but no more than 40 minutes, or even no more than 30 mins, or even no more than 20 minutes.
15. A method according to any preceding claims, wherein in step (ii) the fabric is contacted with a laundry cleaning and/or treatment composition in a wash cycle of an automatic washing machine and wherein the wash cycle is run at a temperature of between 5°C and 50°C, preferably between 10°C and 30°C.

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2016/029482

A. CLASSIFICATION OF SUBJECT MATTER
INV. C11D3/386
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
C11D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2014/087011 A1 (NOVOZYMES AS [DK]) 12 June 2014 (2014-06-12) pages 8-9; claims pages 12-13 page 1 -----	1-15
A	US 6 174 852 B1 (HAYASHI HIROMITSU [JP] ET AL) 16 January 2001 (2001-01-16) column 8, line 35 - line 38; claims; examples -----	1-15
A	US 2010/093595 A1 (HOLZHAUER FREDERICK W [US] ET AL) 15 April 2010 (2010-04-15) paragraph [0068]; claims ----- -/--	1-15

☒ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

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Date of the actual completion of the international search 24 June 2016	Date of mailing of the international search report 05/07/2016
Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Authorized officer Vernier, Frédéric

International application No
PCT/US2016/029482

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
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