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

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
18 August 2011 (18.08.2011)

PCT

(10) International Publication Number
WO 2011/100411 A1

(51) International Patent Classification:
C11D 1/66 (2006.01) *C11D 1/835* (2006.01)
C11D 3/20 (2006.01) *C11D 1/62* (2006.01)
C11D 3/37 (2006.01)

(21) International Application Number:
PCT/US2011/024322

(22) International Filing Date:
10 February 2011 (10.02.2011)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
61/303,849 12 February 2010 (12.02.2010) US

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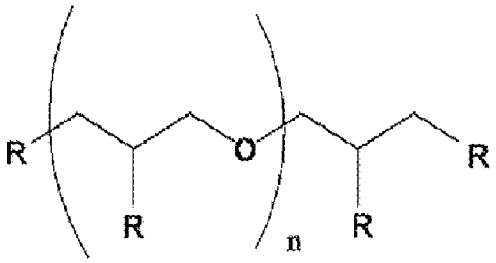
(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PE, PG, PH, PL, PT, RO, RS, RU, 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, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, 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, ML, MR, NE, SN, TD, TG).

Published:
— *with international search report (Art. 21(3))*

WO 2011/100411 A1

(54) Title: BENEFIT COMPOSITIONS COMPRISING POLYGLYCEROL ESTERS



(I)

(57) Abstract: The instant disclosure relates to fabric and household hard surface treatment compositions comprising mixtures of poly glycerol esters, each having the structure of Formula I: wherein each R is independently selected from the group consisting of fatty acid ester moieties comprising carbon chains having a carbon chain length of from about 10 to about 22 carbon atoms; -OH; and combinations thereof; and wherein the mixture of polyglycerol esters has an average value of n ranging from about 1.5 to about 6, has an average % esterification ranging from about 20% to about 100%; has greater than or equal; to about 50% of the polyglycerol esters having at least two ester linkages; and has a polydipsersity index of greater than about 0.75; and a treatment and/or care agent.

BENEFIT COMPOSITIONS COMPRISING POLYGLYCEROL ESTERS

FIELD OF THE INVENTION

The instant disclosure relates to compositions comprising a mixture of polyglycerol esters (PGEs) wherein the polydispersity index of the polyglycerol mixture is greater than 0.75 and a treatment and/or care agent. Methods of making and using said compositions are also disclosed.

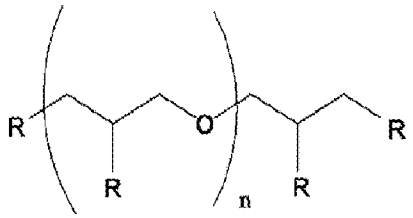
BACKGROUND OF THE INVENTION

Consumer fabric and household hard surface treatment compositions are often formulated to provide improved fabric feel. Such compositions can be formulated, for example, as liquid softening compositions, dryer sheets, or detergent formulations. Unfortunately, depending on the type of softening active used, existing fabric softening compositions can suffer from a variety of disadvantages. For example, currently used actives can be excessively expensive, may impart a greasy feel to textiles, and in some cases, may cause treated fabric to become hydrophobic. In addition, some softening agents, such as quaternary ammonium compounds, can be difficult to formulate with, particularly when combined with anionic surfactants, as flocculation/precipitation may occur. Further, there is a need for fabric softening agents that may be used in compacted or low water formulations, in contrast to currently used fabric softening agents which may be difficult to formulate into low-water compositions. Finally, given the concern for environmentally compatible consumer products, there remains the need for fabric care agents having an improved biodegradeability profile, as many fabric treatment agents are released with the wash/treatment water.

Thus, there is a need in the art to provide fabric care actives having improved attributes with respect to one or more of the aforementioned problems. The instant disclosure addresses one or more of the needs described above.

SUMMARY OF THE INVENTION

The instant disclosure relates to fabric and household hard surface treatment compositions comprising mixtures of polyglycerol esters, each having the structure of Formula I:



(Formula I)

wherein each R is independently selected from the group consisting of fatty acid ester moieties comprising carbon chains having a carbon chain length of from about 10 to about 22 carbon atoms; -OH; and combinations thereof; and wherein the mixture of polyglycerol esters has an average value of n ranging from about 1.5 to about 6, has an average % esterification ranging from about 20% to about 100%; has greater than or equal; to about 50% of the polyglycerol esters having at least two ester linkages; and has a polydipsersity index of greater than about 0.75; and a treatment and/or care agent.. Methods of making and using said compositions are also disclosed.

DETAILED DESCRIPTION OF THE INVENTION

As used herein, the articles including "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 term "comprising" means various components conjointly employed in the preparation of the compositions of the present disclosure. Accordingly, the terms "consisting essentially of" and "consisting of" are embodied in the term "comprising".

As used herein, the term "cationic polymer" means a polymer having a net cationic charge. Polymers containing amine groups or other protonable groups are included in the term "cationic polymers," wherein the polymer is protonated at the pH of the intended use. As used herein, the term "polymer" includes homopolymer, copolymer or terpolymer and polymers with 4 or more type of monomers.

As used herein, an "effective amount" of a material or composition is the amount needed to accomplish an intended purpose, for example, to impart a desired level of fabric care benefit to a substrate.

As used herein, "fabric treatment and/or care compositions" include fabric care compositions for handwash, machine wash and other purposes including fabric care additive compositions and compositions suitable for use in the soaking and/or pretreatment of fabrics. They make take the form of, for example, laundry detergents, fabric conditioners, and other wash, rinse, dryer added products, sprays, or compositions capable of direct application to a textile. The fabric care compositions may take the form of a granular detergent or dryer added fabric softener sheet. The term includes, unless otherwise indicated, granular or powder-form all-purpose or "heavy-duty" washing agents, especially cleaning detergents; liquid, gel or paste-form all-purpose washing agents; liquid fine-fabric detergents; as well as cleaning auxiliaries such as bleach additives and "stain-stick" or pre-treat types, substrate-laden products such as dryer added sheets, dry and wetted wipes and pads, nonwoven substrates, and sponges; as well as sprays and mists.

As used herein, "treatment and/or care agent" refers to any of the agents defined in the disclosure herein.

As used herein, the terms "include," "includes," and "including" are meant to be non-limiting.

As used herein, the term "IV," or "Iodine Value" is the number of grams of iodine absorbed per 100 grams of the sample material. The IV range represents the degree of unsaturation, and can be measured by standard AOCS methods.

As used herein, the polydispersity index is calculated as $\sum_i |n_i - < n >| \cdot x_i$, where n_i is the degree of polymerization of the single oligomer i, <n> is the average degree of polymerization of the polyglycerol mixture, and x_i is the proportion of the oligomer i in the polyglycerol mixture as determined by the GC method described above. For this calculation, the average degree of polymerization <n> is calculated from the hydroxyl value (OHV, in mg KOH/g) according to the formula <n> = (112200 – 18*OHV)/(74*OHV – 56100).

As used herein, the term "situs" includes paper products, fabrics, garments, hard surfaces.

As used herein, "stable" means that no visible phase separation is observed for a period of at least about two weeks, or at least about four weeks, or greater than about a month or greater than about four months, as measured using the Floc Formation Test, described in USPA 2008/0263780 A1.

As used herein, "unit dose" means an amount of fabric care composition suitable to treat one load of laundry, such as from about 0.05 g to about 100 g, from 10 g to about 60 g, or from about 20 g to about 40 g.

As used herein, the term "% esterification," means the percent or average percent of the total OH groups (represented by, for example, "OR" in Formula I) on the polyglycerol that are esterifed. In calculating the % esterification, the total amount of OH groups is assumed to be based on a value of "n+3" with "n" the average degree of oligomerization for the polyglycerols as described above and in Formula 1.

As used herein, "% cyclic" means the percent of PGE's having a cyclic group.

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.

It should be understood that every maximum numerical limitation given throughout this specification includes every lower numerical limitation, as if such lower numerical limitations were expressly written herein. Every minimum numerical limitation given throughout this specification will include every higher numerical limitation, as if such higher numerical limitations were expressly written herein. Every numerical range given throughout this specification will include every narrower numerical range that falls within such broader numerical range, as if such narrower numerical ranges were all expressly written herein.

The instant disclosure relates to fabric treatment and/or care compositions comprising polyglycerol esters. Various uses for polyglycerol esters ("PGEs") are known. See, for example, US 4,214,038 and US 2006/0276370. PGEs are esters typically obtained by reacting a

polyglycerol and a fatty acid. Polyglycerols may be prepared from glycerin as described in the literature, for example, as described in US 6,620,904. In general, oligomerization of the glycerol unit is an intermolecular reaction between two glycerin molecules to form a diglycerol. Two such oligomers can also be reacted together, or an oligomer can be reacted with an additional glycerin to form yet higher oligomers. Polyglycerols may be converted to polyglycerol esters by typical esterification techniques for example, via reaction with fatty acids, fatty acid chlorides, and the like. The fatty acids used in the esterification can be a mixture of fatty acid chain lengths such as, for example, the fatty acid mixtures derived from coconut oil or tallow. The fatty acids may be saturated or unsaturated, and may contain from about 12 to about 22 carbon atoms, or about 10 to 22 carbon atoms. The fatty acid mixtures derived from natural fats and oils such as, for example, rapeseed oil, peanut oil, lard, tallow, coconut oil, soybean oil can be converted to saturated form by hydrogenation, such processes being readily understood by one of ordinary skill in the art. The use of polyglycerol esters in fabric softening applications has been described for example in JP3886310 which claims a fiber softening agent comprising a mixture of polyglycerol fatty acid ester and sucrose fatty acid ester.

Applicants have recognized that by judiciously selecting fatty acid length, the average degree of esterification, the average degree of saturation, and the average number of polyglycerol units (oligomerization) in a PGE, PGE molecules having improved properties, for example, softening, viscosity, biodegradability, or performance of delivery of a perfume benefit can be obtained. Applicants have recognized that specific PGEs having a degree of oligomerization less than about n=1.5 have a decreased softening performance, while PGEs having increased oligomerization have decreased biodegradability properties. Applicants have further recognized that the degree of esterification and the degree of saturation of the fatty acid chain impact softening performance and the feel benefit of PGEs.

Applicants have recognized that polyglycerol esters due to their polymeric nature and due to the methods they are prepared by are statistical mixtures of different compound structure. A polyglycerol molecule may comprise ether bonds between two primary positions, a primary and a secondary position, or two secondary positions of the glycerol monomer units. Cyclic structures comprising one or more cycles may also be present. For tetraglycerol and higher oligomers, branched structures comprising at least one glycerol monomer unit linked to three further glycerol monomer units via an ether linkage may be present. A polyglycerol mixture may contain different oligomers and isomers of these, and may be characterized by the oligomer

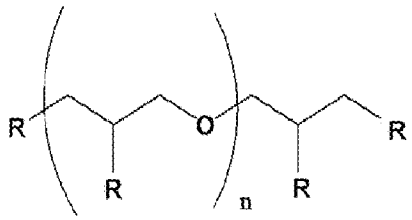
distribution, i. e. the proportion of mono-, di-, tri-, ...-glycerol structures in the mixture. This distribution can for example be determined by high temperature gas chromatography of the polyglycerol mixture after derivatization. Synthesis of single oligoglycerol isomers is described in "Original synthesis of linear, branched and cyclic oligoglycerol standards", Cassel et al., Eur. J. Org. Chem. 2001, 875-896.

Therefore, the esterification of polyglycerol mixtures typically results in a distribution of non-esterified polyglycerol, monoester, diester, triester, etc., where the average degree of esterification is determined by the ratio of fatty acid (or its derivative) to polyglycerol used in the synthesis. If a mixture of different fatty acids is used for the esterification, more than one equal or different fatty acid residues may be linked to one polyglycerol molecule via ester linkage.

In another aspect, Applicants have recognized that the combination of the PGEs disclosed herein and a silicone material results in a synergistic benefit with respect to feel of a fabric. While silicone materials can be used as a lubricant on a fabric surface, inclusion of silicones, in some instances, may result in reduced body/fluffiness of the fabric, particularly when applied to terry towels. The combination of the PGE and silicones, in contrast, provide a smooth surface with increased body to provide a smooth fluffy soft feel benefit. Applicants have further recognized that the inclusion of silicones with the disclosed PGEs results in compositions having a more desirable viscosity.

Applicants have further recognized that there are differences in water solubility among PGEs influence desirability of use. For example, solubilities for monoester diglycerols and higher glycerols are significantly greater than what may be suitable for a composition in which PGE deposition may be desired. In contrast, the corresponding diester solubilities are several orders of magnitude lower and significantly less than typical in wash (or in rinse) concentrations. As such, the monoesters are disfavored where efficient deposition of the PGE may be desired.

The fabric and household hard surface treatment compositions of the present invention comprise a mixture of polyglycerol esters each having the structure of Formula I:



Formula I

wherein the polydipsersity index of the mixture of polyglycerol esters is greater than about 0.75.

In one aspect, the compositions provide, but are not limited to, performance characteristics that include fabric softening and/or static performance based upon IV ranges. In one aspect, the PGE may be saturated (having an iodine value of about 0 to about 20) or unsaturated (having an iodine value of about 45 to about 135), or may comprise combinations thereof. For example, in one aspect, the PGEs of the compositions have an IV range of from about 40 to about 140; alternatively from about 35 to about 65, alternatively from about 40 to about 60; alternatively from about 1 to about 60, alternatively from about 15 to about 30, alternatively from about 15 to about 25. Further, while it may be acceptable to use cationic softening compounds at a transition temperature from about -50°C to about 100°C, in one aspect, the disclosed PGEs may have a transition temperature of equal to or less than about 50°C.

In one aspect, the fatty acid carbon chain length may be from about 10 to 22, or about 12 to 18 or about 16 to 18 carbon atoms.

In one aspect, n, for Formula I above, may be about 1.5 to about 6, or about 1.5 to about 3.5 or about 1.5 to about 4.5 or about 1.5 to about 5.

In one aspect, the fabric treatment composition may comprise a PGE of Formula I wherein each R is independently selected from the group consisting of fatty acid ester moieties comprising carbon chains, said carbon chains having a carbon chain length of from about 10 to about 22 carbon atoms; -OH; and combinations thereof;

wherein

a) when n may be from about 1.5 to about 6, the average % esterification of the PGE may be from about 20% to about 100%;

b) when n may be from about 1.5 to about 5, the average % esterification may be from about 20% to about 90%

c) when n may be from about 1.5 to about 4, the average % esterification may be from about 20% to about 80%;

wherein more than about 50% of the PGE mixture has at least two ester linkages.

In another aspect, the composition may comprise a PGE of Formula I

wherein the fatty acid moieties' carbon chains have an average chain length of from about 10 to about 22 carbon atoms;

wherein the PGE has an iodine value of about 0 to about 145;

wherein

a) when n may be from about 3 to about 6, the % esterification may be from about 20% to about 100%;

b) when n may be from about 3 to about 6, the % esterification may be from about 25% to about 90%; and

c) when n may be from about 3 to about 6, the % esterification may be from about 35% to about 90%.

In yet another aspect, the composition may comprise a PGE of Formula I wherein the fatty acid moieties' carbon chains have an average carbon chain length of about 16 to 18 carbon atoms;

wherein the PGE has an iodine value of from about 0 to about 20;

wherein

a) when n may be from about 1.5 to about 3.5, the % esterification may be from about 20% to about 60%;

b) when n may be from about 1.5 to about 4.5, the % esterification may be from about 20% to about 70%; and

b) when n may be from about 1.5 to about 6, the % esterification may be from about 20% to about 80%.

In yet another aspect, the composition may comprise a PGE of Formula I

wherein the fatty acid moieties' carbon chains have an average carbon chain length of from about 16 to about 18 carbon atoms;

wherein the PGE has an iodine value of about 45 to about 135; and

wherein

a) when n may be from about 1.5 to about 3, the % esterification may be from about 70% to about 100%;

b) when n may be from about 1.5 to about 4.5, the % esterification may be from about 50% to 100%; and

c) when n may be from about 1.5 to about 6, the % esterification may be from about 25% to 60%.

In a yet further aspect, the composition may comprise a PGE of Formula I,

wherein

a) when n may be from about 3 to about 6, the % esterification may be from about 15% to about 100%;

b) when n may be from about 3 to about 6, the % esterification may be from about 25% to about 90%;

c) when n may be from about 3 to about 6, the % esterification may be from about 35% to about 90%.

Exemplary commercially available PGEs include Mazol® PGO 31K, Mazol® PGO 104K from BASF; Caprol® MPGO, Caprol® ET from Abitec Corp.; Grindsted® PGE 382, Grindsted® PGE 55, Grindsted® PGE 60 from Danisco; Varonic® 14, TegoSoft® PC 31, Isolan® GO 33, Isolan® GI 34 from Evonik Industries.

In one aspect, the composition may comprise a PGE of Formula I wherein the fatty acid moieties' carbon chains have an average carbon chain length of about 12 to 18 carbon atoms and an iodine value of about 0 to about 145, and when n may be from about 1.5 to about 6, the % esterification may be from about 20% to 80%.

In another aspect, the composition may comprise a PGE having the structure of Formula I, wherein each R may be independently selected from the group consisting of fatty acids having carbon chain lengths of about 12 to 18 carbon atoms, fatty acid moieties having carbon chain lengths of about 15 to 18 carbon atoms, -OH, and mixtures thereof; wherein the fatty acid may be selected from the group consisting of saturated fatty acids, unsaturated fatty acids, and combinations thereof.

In one aspect, the fatty acid may be saturated, having an IV of about 0 to about 20.

In one aspect, the fatty acid may be branched, linear, or further functionalized, for example, by modification such that the fatty acid contains one or more hydroxyl groups.

In one aspect, at least 50%, or at least 75%, of the PGE molecules comprise at least two ester linkages.

The degree of oligomerization which is represented by "n" is generally understood to be an average representing a distribution of oligomers.) While applicants have recognized that the number of polyglycerol units may be as large as greater than about 10, such molecules have decreased biodegradability and are therefore disfavored. The structure of Formula I is intended to include both linear and/or branched structures. The control of the degree and distribution of oligomers may be controlled to some extent by either physical means (e.g., distillation) or by varying the reaction conditions, as described in USPN 6,620,904.

Polyglycerol obtained by hydrolysis of the polyglycerol partial ester may comprise a polydispersity index of greater than 0.75, or greater than 1.0, or greater than 1.5.

Polyglycerol may comprise different percentages of cyclic structures. An overview of some cyclic structures present in commercial polyglycerol mixtures is given in "Original synthesis of linear, branched and cyclic oligoglycerol standards", Cassel et al., Eur. J. Org. Chem. 2001, 875-896. For the polyglycerol partial esters it may be advantageous if the polyglycerol in the polyglycerol backbone of the partial ester comprises at least about 1 %, or at least about 2 %, or at least about 3 % cyclic structures. The given percentages are neither percentages by weight nor per mole but are determined by the GC method described above.

In another aspect, the PGEs may further comprise one or more cyclic polyglycerol ("CPG"). In addition to the above oligomerization reaction, an equivalent intramolecular reaction can occur within an oligomer to for a cyclic analog to the oligomer. The formation of cyclic groups reduces the number of free OH groups relative to non-cyclics. The % cyclic, as used herein, indicates the percent of PGE's having a cyclic group. Applicants have observed that as chain length increases, biodegradability of the PGE decreases. Without intending to be limited by theory, applicants believe that the decrease in biodegradability could be attributed to either the increase in oligomerization itself, or rather, to the increase in cyclic structures that are prone to occur as oligomerization may be increased, or to a combination of both.

In one aspect, the composition may comprise, based on total weight of the composition, from about 5% to about 70%, or from about 10% to about 50%, or from about 15% to about 30% of a PGE.

In one aspect, the composition may comprise a PGE comprising at least a diester. In one aspect, the PGE may comprise, based on total weight of the PGE, from about 50% to about 100% of a diester. In yet another aspect, the PGEs of the instant composition comprise a diester, a triester, a tetraester, a hexaester or an octaester, for example, greater than about 50% of an diester, a triester, a tetraester, pentaester, a hexaester, a heptaester, or an octaester, or combinations thereof.

In one aspect, the PGE may comprise, based on total weight of the PGE, from about 50% to 100%, or from about 75% to about 90%, of an ester linkages selected from the group consisting of a diester, a triester, a tetraester, a hexaester, a heptaester, an octaester, and combinations thereof.

In a yet further aspect, from about 1% to about 50% or from about 5% to about 20% or less than about 10% of the PGE may comprise a monoester.

The disclosed compositions of the present invention may include a variety of fabric care compositions, such as, for example, fabric enhancer compositions in which a feel benefit, such as softening benefit, is desired.

The fabric treatment compositions comprise suitable "treatment and/or care agents" which include any known material suitable for the treatment or care of fabrics or other situs. The treatment and/or care agents may include , for example, polymers, including cationic polymers, surfactants, builders, chelating agents, dye transfer inhibiting agents, dispersants, enzymes, and enzyme stabilizers, catalytic materials, bleach activators, polymeric dispersing agents, clay soil removal/anti-redeposition agents, brighteners, suds suppressors, dyes, perfume and/or perfume delivery systems, structure elasticizing agents, fabric softeners, carriers, hydrotropes, processing aids and/or pigments.

In one aspect, the treatment and/or care agent may be selected from the group consisting of organosilicones, quaternary ammonium compounds, and combinations thereof.

In one aspect, the treatment and/or care agent may comprise an organosilicone. Suitable organosilicones comprise Si-O 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. In one aspect, the organosilicones may comprise a viscosity of from about 10 to about 2,000,000 centistokes at 25°C. In another aspect, suitable organosilicones may have a viscosity of from about 10 to about 800,000 centistokes at 25°C.

Suitable organosilicones may be linear, branched or cross-linked. In one aspect, the organosilicones may be linear.

In one aspect, the organosilicone may comprise a non-functionalized siloxane polymer that may have Formula I below, and may comprise polyalkyl and/or phenyl silicone fluids, resins and/or gums.

$$[R_1R_2R_3SiO_{1/2}]_n\,[R_4R_4SiO_{2/2}]_m[R_4SiO_{3/2}]_j \qquad \text{(Formula I)}$$

wherein:

i) each R_1, R_2, R_3 and R_4 may be independently selected from the group consisting of H, -OH, C_1-C_{20} alkyl, C_1-C_{20} substituted alkyl, C_6-C_{20} aryl, C_6-C_{20} substituted aryl, alkylaryl, and/or C_1-C_{20} alkoxy, moieties;

ii) n may be an integer from about 2 to about 10, or from about 2 to about 6; or 2; such that n = j+2;

iii) m may be an integer from about 5 to about 8,000, from about 7 to about 8,000 or from about 15 to about 4,000;

iv) j may be an integer from about 0 to about 10, or from about 0 to about 4, or 0;

In one aspect, R_2, R_3 and R_4 may comprise methyl, ethyl, propyl, C_4-C_{20} alkyl, and/or C_6-C_{20} aryl moieties. In one aspect, each of R_2, R_3 and R_4 may be methyl. Each R_1 moiety blocking the ends of the silicone chain may comprise a moiety selected from the group consisting of hydrogen, methyl, methoxy, ethoxy, hydroxy, propoxy, and/or aryloxy.

As used herein, the nomenclature SiO"n"/2 represents the ratio of oxygen and silicon atoms. For example, $SiO_{1/2}$ means that one oxygen is shared between two Si atoms. Likewise $SiO_{2/2}$ means that two oxygen atoms are shared between two Si atoms and $SiO_{3/2}$ means that three oxygen atoms are shared are shared between two Si atoms.

In one aspect, 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 trade names DC 200 Fluid, DC 1664, DC 349, DC 346G available from offered by Dow Corning Corporation, Midland, MI, and those available under the trade names SF1202, SF1204, SF96, and Viscasil® available from Momentive Silicones, Waterford, NY.

In one aspect, the organosilicone may comprise a cyclic silicone. The cyclic silicone may comprise a cyclomethicone of the formula $[(CH_3)_2SiO]_n$ where n is an integer that may range from about 3 to about 7, or from about 5 to about 6.

In one aspect, the organosilicone may comprise a functionalized siloxane polymer. Functionalized siloxane polymers may comprise one or more functional moieties 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.

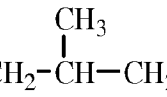
In one aspect, the functionalized siloxane polymer may comprise a silicone polyether, also referred to as "dimethicone copolyol." In general, silicone polyethers comprise a polydimethylsiloxane backbone with one or more polyoxyalkylene chains. The polyoxyalkylene moieties may be incorporated in the polymer 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.

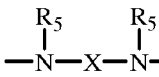
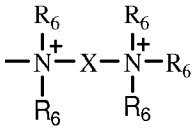
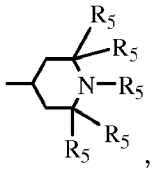
In another aspect, the functionalized siloxane polymer may comprise an aminosilicone. Suitable aminosilicones are described in USPNs 7,335,630 B2, 4,911,852, and USPA 2005/0170994A1. In one aspect the aminosilicone may be that described in USPA 61/221,632. In one aspect, the aminosilicone may comprise the structure of Formula II:

$$[R_1R_2R_3SiO_{1/2}]_n[(R_4Si(X\text{-}Z)O_{2/2}]_k[R_4R_4SiO_{2/2}]_m[R_4SiO_{3/2}]_j \qquad \text{(Formula II)}$$

wherein

i. R_1, R_2, R_3 and R_4 may each be independently selected from H, OH, C_1-C_{20} alkyl, C_1-C_{20} substituted alkyl, C_6-C_{20} aryl, C_6-C_{20} substituted aryl, alkylaryl, and/or C_1-C_{20} alkoxy;

ii. Each X may be independently selected from a divalent alkylene radical comprising 2-12 carbon atoms, -(CH_2)s- wherein s may be an integer from about 2 to about 10; –CH_2–CH(OH)-CH_2–; and/or  ;

iii. Each Z may be independently selected from–$N(R_5)_2$; –$N(R_5)_3A^-$,  or  $2A^-$ and/or  , wherein each R_5 may be selected independently selected from H, C_1-C_{20} alkyl, C_1-C_{20} substituted alkyl, C_6-C_{20} aryl, C_6-C_{20} and/or substituted aryl, each R_6 may be independently selected from H, OH, C_1-C_{20} alkyl, C_1-C_{20} substituted alkyl, C_6-C_{20} aryl, C_6-C_{20} substituted aryl, alkylaryl, and/or C_1-C_{20} alkoxy; and A^- may be a compatible anion. In one aspect, A^- may be a halide;

iv. k may be an integer from about 3 to about 20, or from about 5 to about 18 more or from about 5 to about 10;

v. m may be an integer from about 100 to about 2,000, or from about 150 to about 1,000;

vi. n may be an integer from about 2 to about 10, or about 2 to about 6, or 2, such that n = j+2; and

vii. j may be an integer from about 0 to about 10, or from about 0 to about 4, or 0;

In one aspect, R_1 may comprise –OH. In this aspect, the organosilicone may be amodimethicone.

Exemplary commercially available aminosilicones include DC 8822, 2-8177, and DC-949, available from Dow Corning Corporation, and KF-873, available from Shin-Etsu Silicones, Akron, OH.

In one aspect, the organosilicone may comprise amine ABn silicones and quat ABn silicones. Such organosilicones are generally produced by reacting a diamine with an epoxide. These are described, for example, in USPNs 6,903,061 B2, 5,981,681, 5,807,956, 6,903,061 and 7,273,837. These are commercially available under the trade names Magnasoft® Prime, Magnasoft® JSS, Silsoft® A-858 (all from Momentive Silicones).

In another aspect, the functionalized siloxane polymer may comprise silicone-urethanes, such as those described in USPA 61/170,150. These are commercially available from Wacker Silicones under the trade name SLM-21200.

When a sample of organosilicone is analyzed, it is recognized by the skilled artisan that such sample may have, on average, non-integer indices for Formula I and II above, but that such average indice values will be within the ranges of the indices for Formula I and II above.

In one aspect, the treatment and/or care agent may comprise an additional fabric softening compounds. Suitable fabric softening compounds are disclosed in USPA 2004/0204337.

In one aspect, the fabric softening active may comprise a quaternary ammonium compound. In one aspect, the quaternary ammonium compound may comprise a quaternary ammonium compound selected from the group consisting of an ester quaternary ammonium compound, an alkyl quaternary ammonium compound, or mixtures thereof.

In one aspect, the ester quaternary ammonium compound may comprise a mixture of mono- and di-ester quaternary ammonium compound. Those skilled in the art will recognize that cationic softening compounds can be selected from mono-, di-, and tri-esters, as well as other cationic softening compounds, and mixtures thereof, depending on the process and the starting materials, and that cationic softening compounds can be selected from tertiary ammonium compounds, as well as other cationic softening compounds, and mixtures thereof. Additional suitable fabric softening compounds are disclosed in USPA 2004/0204337. In one aspect, the composition may comprise a biodegradable quaternary ammonium compound. In one aspect, the composition may

comprise a biodegradable quaternary ammonium compound and a biodegradable PGE in a chemically stable matrix.

In one aspect, the composition may comprise a quaternary ammonium composition having from about 0.1% to about 30% of mono-ester quaternary ammonium, or from about 0.5% to about 20% of mono-ester quaternary ammonium, by weight of fabric enhancer, or from about 2% to about 12% of mono-ester quaternary ammonium, by weight of the composition.

In one aspect, the composition may comprise from about 1%, or from about 2%, or from about 3%, or from about 5%, or from about 10%, or from about 12%, to about 90%, or to about 40%, or to about 30%, or to about 20%, or to about 18%, or to about 15%, of said quaternary ammonium compound, by weight of the composition.

In one aspect, the composition may comprise a PGE and a quaternary ammonium compound at a ratio of from about 100:1 to about 1:1, or about 20:1 to about 1:1, or about 10:1 to about 1:1. In one aspect, the amount of quaternary ammonium compound may exceed the amount of PGE in the composition.

In one aspect, the composition comprising the PGE and the quaternary ammonium compound may have a pH from about 2.5 to about 4.

In one aspect, the treatment and/or care agent may comprise a perfume and a cationic polymer.

In one aspect, the treatment and/or care agent may comprise a perfume, and a quaternary ammonium compound.

In yet another aspect, the treatment and/or care agent may comprise a perfume, a cationic polymer and a quaternary ammonium compound.

Additional Treatment and/or Care Agents - While not essential, the non-limiting list of materials illustrated hereinafter are suitable for use in the instant compositions and may be desirably incorporated in certain aspects, for example to assist or enhance cleaning performance, for treatment of the substrate to be cleaned, or to modify the aesthetics of the cleaning composition as may be the case with perfumes, colorants, or the like. The precise nature of these additional components, and levels of incorporation thereof, will depend on the physical form of the composition and the nature of the cleaning operation for which it is to be used. Suitable adjunct

materials include, but are not limited to, surfactants, builders, chelating agents, dye transfer inhibiting agents, dispersants, enzymes, and enzyme stabilizers, polymeric dispersing agents, structurants, clay soil removal/anti-redeposition agents, brighteners, suds suppressors, perfumes, structure elasticizing agents, fabric softeners, carriers, hydrotropes, processing aids, solvents and/or pigments.

Certain aspects of Applicants' compositions do not contain one or more of the following materials: bleach activators, surfactants, builders, chelating agents, dye transfer inhibiting agents, dispersants, enzymes, and enzyme stabilizers, catalytic metal complexes, polymeric dispersing agents, clay and soil removal/anti-redeposition agents, brighteners, suds suppressors, dyes, perfumes and/or perfume delivery systems, structure elasticizing agents, fabric softeners, carriers, hydrotropes, processing aids and/or pigments.

The treatment and/or care agents may include those listed. Suitable examples of other such treatment and/or care agents and levels of use may also be found in USPNs 5,576,282, 6,306,812 B1 and 6,326,348 B1:

Surfactants - In one aspect, the fabric care compositions may comprise from about 0.01% to 80% by weight of a surfactant, or about 1% to about 50% of a surfactant. Surfactants utilized can be of the anionic, nonionic, zwitterionic, ampholytic or cationic type or can comprise compatible mixtures of these types. Detergent surfactants useful herein are described in, for example, USPNs 3,664,961, 3,919,678, 4,222,905, and 4,239,659. Anionic and nonionic surfactants are useful if the fabric care product is a laundry detergent, for example, those described in USPNs 6,020,303 and 6,593,285. Cationic surfactants are generally useful if the fabric care product is a fabric softener.

Anionic Surfactants - Useful anionic surfactants can themselves be of several different types, for example, the water-soluble salts, particularly the alkali metal, ammonium and alkylolammonium (e.g., monoethanolammonium or triethanolammonium) salts, of organic sulfuric reaction products having in their molecular structure an alkyl group containing from about 10 to about 20 carbon atoms and a sulfonic acid or sulfuric acid ester group. (Included in the term "alkyl" is the alkyl portion of aryl groups.) Examples of this group of synthetic surfactants are the alkyl sulfates and alkyl alkoxy sulfates, especially those obtained by sulfating the higher alcohols (C_{8-18} carbon atoms).

Other anionic surfactants useful with the compositions described herein are the water-soluble salts of: paraffin sulfonates containing from about 8 to about 24 (alternatively about 12 to 18) carbon atoms; alkyl glyceryl ether sulfonates, especially those ethers of C_{8-18} alcohols (e.g., those derived from tallow and coconut oil); alkyl phenol ethylene oxide ether sulfates containing from about 1 to about 4 units of ethylene oxide per molecule and from about 8 to about 12 carbon atoms in the alkyl group; and alkyl ethylene oxide ether sulfates containing about 1 to about 4 units of ethylene oxide per molecule and from about 10 to about 20 carbon atoms in the alkyl group.

Other useful anionic surfactants herein include the water-soluble salts of esters of α-sulfonated fatty acids. In another aspect, the anionic surfactant may comprise a C_{11}-C_{18} alkyl benzene sulfonate surfactant; a C_{10}-C_{20} alkyl sulfate surfactant; a C_{10}-C_{18} alkyl alkoxy sulfate surfactant, having an average degree of alkoxylation of from 1 to 30, wherein the alkoxy may comprise a C_1 to C_4 chain and mixtures thereof; a mid-chain branched alkyl sulfate surfactant; a mid-chain branched alkyl alkoxy sulfate surfactant having an average degree of alkoxylation of from 1 to 30, wherein the alkoxy may comprise a C_1 to C_4 chain and mixtures thereof; a C_{10}-C_{18} alkyl alkoxy carboxylates comprising an average degree of alkoxylation of from 1 to 5; a C_{12}-C_{20} methyl ester sulfonate surfactant, a C_{10}-C_{18} alpha-olefin sulfonate surfactant, a C_6-C_{20} sulfosuccinate surfactant, and a mixture thereof.

Nonionic Surfactants - In addition to the anionic surfactant, the fabric care compositions may further contain a nonionic surfactant. The compositions may contain up to about 30%, alternatively from about 0.01% to about 20%, more alternatively from about 0.1% to about 10%, by weight of the composition, of a nonionic surfactant. In one aspect, the nonionic surfactant may comprise an ethoxylated nonionic surfactant. Examples of suitable non-ionic surfactants are provided in U.S. Pat. No. 4,285,841, Barrat *et al*, issued Aug. 25, 1981. Suitable for use herein are the ethoxylated alcohols and ethoxylated alkyl phenols of the formula $R(OC_2H_4)_n$ OH, wherein each R may be independently selected from the group consisting of aliphatic hydrocarbon radicals containing from about 8 to about 15 carbon atoms and alkyl phenyl radicals in which the alkyl groups contain from about 8 to about 12 carbon atoms, and the average value of n may be from about 5 to about 15. Additional non-limiting examples are disclosed in U.S. Patent 2,965,576 and U.S. Patent 2,703,798.

Cationic Surfactants - The fabric care compositions may contain up to about 30%, from about 0.01% to about 20%, or from about 0.1% to about 20%, by weight of the composition, of a cationic surfactant. Useful cationic surfactants include those which can deliver fabric care benefits. Non-limiting examples of useful cationic surfactants include: fatty amines; quaternary ammonium surfactants; and imidazoline quat materials.

Amphoteric Surfactants – Non-limiting examples of ampholytic surfactants include: aliphatic derivatives of secondary or tertiary amines, or aliphatic derivatives of heterocyclic secondary and tertiary amines in which the aliphatic radical can be straight- or branched-chain. One of the aliphatic substituents contains at least about 8 carbon atoms, typically from about 8 to about 18 carbon atoms, and at least one contains an anionic water-solubilizing group, e.g. carboxy, sulfonate, sulfate. See USPN 3,929,678 for examples of ampholytic surfactants.

Builders - The compositions may comprise one or more detergent builders or builder systems.

Chelating Agents - The compositions herein may also optionally contain one or more copper, iron and/or manganese chelating agents. If utilized, chelating agents will generally comprise from about 0.1% by weight of the compositions herein to about 15%, or even from about 3.0% to about 15% by weight of the compositions herein.

Dye Transfer Inhibiting Agents - The compositions may also include one or more dye transfer inhibiting agents. Suitable polymeric dye transfer inhibiting agents include, but are not limited to, polyvinylpyrrolidone polymers, polyamine N-oxide polymers, copolymers of N-vinylpyrrolidone and N-vinylimidazole, polyvinyloxazolidones and polyvinylimidazoles or mixtures thereof. When present in the compositions herein, the dye transfer inhibiting agents are present at levels from about 0.0001%, from about 0.01%, from about 0.05% by weight of the cleaning compositions to about 10%, about 2%, or even about 1% by weight of the cleaning compositions.

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

Enzymes - The compositions can comprise one or more detergent enzymes which 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, keratanases, reductases, oxidases, phenoloxidases, lipoxygenases, ligninases, pullulanases, tannases, pentosanases, malanases, ß-glucanases, arabinosidases, hyaluronidase, chondroitinase, laccase, and amylases, or mixtures thereof. A typical combination may be a cocktail of conventional applicable enzymes like protease, lipase, cutinase and/or cellulase in conjunction with amylase.

Enzyme Stabilizers - Enzymes for use in compositions, for example, detergents can be stabilized by various techniques. The enzymes employed herein can be stabilized by the presence of water-soluble sources of calcium and/or magnesium ions in the finished compositions that provide such ions to the enzymes.

Catalytic Metal Complexes – Applicants' compositions may include catalytic metal complexes. Suitable catalysts are disclosed, for example, in USPNs 4,430,243, 5,576,282, 5,597,936, 5,595,967, 5,597,936, and 5,595,967. Compositions may also include a transition metal complex of a macropolycyclic rigid ligand "MRL". The compositions and cleaning processes herein can be adjusted to provide on the order of at least one part per hundred million of the benefit agent MRL species in the aqueous washing medium, and may 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 manganese, iron and chromium. Other suitable MRL's herein are a special type of ultra-rigid ligand that may be cross-bridged such as 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 USPN 6,225,464.

Fabric Softening Actives - The composition may comprise additional fabric softening actives (FSA) or a mixture of more than one FSAs such as those described in USPA 11/890924.

Deposition Aid - In one aspect, the fabric treatment composition may comprise from about 0.01% to about 10%, from about 0.05 to about 5%, or from about 0.15 to about 3% of a deposition aid. Suitable deposition aids are disclosed in, for example, USPA 12/080,358.

In one aspect, the deposition aid may be a cationic or amphoteric polymer. In one aspect, the deposition aid may be a cationic polymer. Cationic polymers in general and their method of manufacture are known in the literature. In one aspect, the cationic polymer may have a cationic charge density of from about 0.005 to about 23, from about 0.01 to about 12, or from about 0.1 to about 7 milliequivalents/g, at the pH of intended use of the composition. For amine-containing polymers, wherein the charge density depends on the pH of the composition, charge density is measured at the intended use pH of the product. Such pH will generally range from about 2 to about 11, more generally from about 2.5 to about 9.5. Charge density is calculated by dividing the number of net charges per repeating unit by the molecular weight of the repeating unit. The positive charges may be located on the backbone of the polymers and/or the side chains of polymers.

One group of suitable cationic polymers includes those produced by polymerization of ethylenically unsaturated monomers using a suitable initiator or catalyst, such as those disclosed in WO 00/56849 and USPN 6,642,200.

Suitable polymers may be selected from the group consisting of cationic or amphoteric polysaccharide, polyethylene imine and its derivatives, and a synthetic polymer made by polymerizing one or more cationic monomers selected from the group consisting of N,N-dialkylaminoalkyl acrylate, N,N-dialkylaminoalkyl methacrylate, N,N-dialkylaminoalkyl acrylamide, N,N-dialkylaminoalkylmethacrylamide, quaternized N, N dialkylaminoalkyl acrylate quaternized N,N-dialkylaminoalkyl methacrylate, quaternized N,N-dialkylaminoalkyl acrylamide, quaternized N,N-dialkylaminoalkylmethacrylamide, Methacryloamidopropyl-pentamethyl-1,3-propylene-2-ol-ammonium dichloride, N,N,N,N',N',N'',N''-heptamethyl-N''-3-(1-oxo-2-methyl-2- propenyl)aminopropyl-9- oxo-8-azo-decane-1,4,10-triammonium trichloride, vinylamine and its derivatives, allylamine and its derivatives, vinyl imidazole, quaternized vinyl imidazole and diallyl dialkyl ammonium chloride and combinations thereof, and optionally a second monomer selected from the group consisting of acrylamide, N,N-dialkyl acrylamide, methacrylamide, N,N-dialkylmethacrylamide, C_1-C_{12} alkyl acrylate, C_1-C_{12} hydroxyalkyl acrylate, polyalkylene glyol acrylate, C_1-C_{12} alkyl methacrylate, C_1-C_{12} hydroxyalkyl methacrylate, polyalkylene glycol methacrylate, vinyl acetate, vinyl alcohol, vinyl formamide, vinyl acetamide, vinyl alkyl ether, vinyl pyridine, vinyl pyrrolidone, vinyl imidazole, vinyl caprolactam, and derivatives, acrylic acid, methacrylic acid, maleic acid, vinyl sulfonic acid, styrene sulfonic acid, acrylamidopropylmethane sulfonic acid (AMPS) and their salts. The

polymer may optionally be branched or cross-linked by using branching and crosslinking monomers. Branching and crosslinking monomers include ethylene glycoldiacrylate divinylbenzene, and butadiene. A suitable polyethyleneinine useful herein is that sold under the tradename Lupasol® by BASF, AG, Lugwigschaefen, Germany.

In another aspect, the treatment composition may comprise an amphoteric deposition aid polymer so long as the polymer possesses a net positive charge. Said polymer may have a cationic charge density of about 0.05 to about 18 milliequivalents/g.

In another aspect, the deposition aid may be selected from the group consisting of cationic polysaccharide, polyethylene imine and its derivatives, poly(acrylamide-co-diallyldimethylammonium chloride), poly(acrylamide-methacrylamidopropyltrimethyl ammonium chloride), poly(acrylamide-co-N,N-dimethyl aminoethyl acrylate) and its quaternized derivatives, poly(acrylamide-co-N,N-dimethyl aminoethyl methacrylate) and its quaternized derivative, poly(hydroxyethylacrylate-co-dimethyl aminoethyl methacrylate), poly(hydroxpropylacrylate-co-dimethyl aminoethyl methacrylate), poly(hydroxpropylacrylate-co-methacrylamidopropyltrimethylammonium chloride), poly(acrylamide-co-diallyldimethylammonium chloride-co-acrylic acid), poly(acrylamide-methacrylamidopropyltrimethyl ammonium chloride-co-acrylic acid), poly(diallyldimethyl ammonium chloride), poly(vinylpyrrolidone-co-dimethylaminoethyl methacrylate), poly(ethyl methacrylate-co-quaternized dimethylaminoethyl methacrylate), poly(ethyl methacrylate-co-oleyl methacrylate-co-diethylaminoethyl methacrylate), poly(diallyldimethylammonium chloride-co-acrylic acid), poly(vinyl pyrrolidone-co-quaternized vinyl imidazole) and poly(acrylamide-co-Methacryloamidopropyl-pentamethyl-1,3-propylene-2-ol-ammonium dichloride), Suitable deposition aids include Polyquaternium-1, Polyquaternium-5, Polyquaternium-6, Polyquaternium-7, Polyquaternium-8, Polyquaternium-11, Polyquaternium-14, Polyquaternium-22, Polyquaternium-28, Polyquaternium-30, Polyquaternium-32 and Polyquaternium-33, as named under the International Nomenclature for Cosmetic Ingredients.

In one aspect, the deposition aid may comprise polyethyleneimine or a polyethyleneimine derivative. In another aspect, the deposition aid may comprise a cationic acrylic based polymer. In a further aspect, the deposition aid may comprise a cationic polyacrylamide. In another aspect, the deposition aid may comprise a polymer comprising polyacrylamide and polymethacrylamidoproply trimethylammonium cation. In another aspect, the deposition aid

may comprise poly(acrylamide- N-dimethyl aminoethyl acrylate) and its quaternized derivatives. In this aspect, the deposition aid may be that sold under the tradename Sedipur®, available from BTC Specialty Chemicals, a BASF Group, Florham Park, N.J. In a yet further aspect, the deposition aid may comprise poly(acrylamide-co-methacrylamidopropyltrimethyl ammonium chloride). In another aspect, the deposition aid may comprise a non-acrylamide based polymer, such as that sold under the tradename Rheovis® CDE, available from Ciba Specialty Chemicals, a BASF group, Florham Park, N.J., or as disclosed in USPA 2006/0252668.

In another aspect, the deposition aid may be selected from the group consisting of cationic or amphoteric polysaccharides. In one aspect, the deposition aid may be selected from the group consisting of cationic and amphoteric cellulose ethers, cationic or amphoteric galactomanan, cationic guar gum, cationic or amphoteric starch, and combinations thereof

Another group of suitable cationic polymers may include alkylamine-epichlorohydrin polymers which are reaction products of amines and oligoamines with epicholorohydrin, for example, those polymers listed in, for example, USPNs 6,642,200 and 6,551,986. Examples include dimethylamine-epichlorohydrin-ethylenediamine, available under the trade name Cartafix® CB and Cartafix® TSF from Clariant, Basle, Switzerland.

Another group of suitable synthetic cationic polymers may include polyamidoamine-epichlorohydrin (PAE) resins of polyalkylenepolyamine with polycarboxylic acid. The most common PAE resins are the condensation products of diethylenetriamine with adipic acid followed by a subsequent reaction with epichlorohydrin. They are available from Hercules Inc. of Wilmington DE under the trade name Kymene™ or from BASF AG (Ludwigshafen, Germany) under the trade name Luresin™. These polymers are described in Wet Strength resins and their applications edited by L. L. Chan, TAPPI Press (1994), at pp. 13-44.

The cationic polymers may contain charge neutralizing anions such that the overall polymer is neutral under ambient conditions. Non-limiting examples of suitable counter ions (in addition to anionic species generated during use) include chloride, bromide, sulfate, methylsulfate, sulfonate, methylsulfonate, carbonate, bicarbonate, formate, acetate, citrate, nitrate, and mixtures thereof.

The weight-average molecular weight of the polymer may be from about 500 to about 5,000,000, or from about 1,000 to about 2,000,000, or from about 2,500 to about 1,500,000 Daltons, as determined by size exclusion chromatography relative to polyethyleneoxide standards with RI

detection. In one aspect, the MW of the cationic polymer may be from about 500 to about 37,500 Daltons.

In one aspect, the composition may comprise an adjunct selected from the group comprising a paraffin or perfume containing microcapsule such as those described in USPAs 11/145904; and 11/706675; USPN 4,675,022; JP 7,003,639.

In one aspect, the composition may be in a form selected from the group consisting of solid powder, tablet, liquid, gel, and combinations thereof. In one aspect, the composition may be in a unit dose form selected from the group consisting of a tablet, a pouch, and combinations thereof.

In one aspect, an article comprising the composition described herein is disclosed. The article may be selected from the group consisting of bars, sticks, substrate-laden products such as dryer-added sheets, dry and wetted wipes and pads, non-woven substrates, sponges, containers capable of delivering a spray and/or a mist, and combinations thereof.

In one aspect, a method of treating and/or cleaning a situs comprising the steps of a) optionally washing and/or rinsing said situs; b) contacting said situs with a co-particle and/or the product described herein; and c) optionally, washing and/or rinsing said situs is disclosed. In one aspect, a situs treated with the composition described herein is disclosed.

Example: Diesterification of Triglycerol using C_{16} and C_{18} Acid Chlorides

A 12.89g (0.054 mol) of triglycerol (Fluka ≥80%) is placed into a dry, 500-ml, 3-neck, round-bottom flask equipped with mechanical stirring, thermometer, condenser, and positive N_2. A 76-ml sample of anhydrous THF is transferred by canula into the flask. The flask is then placed in an oil bath and heated to 48°C. After heating, 0.79g (0.006 mol) 4-(dimethylamino)pyridine (Alfa Aesar 99%) and 10.88g (0.107 mol) triethylamine (Aldrich) are added to the flask followed by 27-mls of Tetrahydrofuran (Oxacyclopentane) to rinse in Et_3N. 14.98g (0.054 mol) palmitoyl acid chloride (Aldrich, 98.5%) and 16.43g (0.054 mol) stearoyl acid chloride (TCI, 99%) are then mixed in a 125-ml addition funnel with 53-mls THF. The solution of acid chlorides is then dripped into the clear, 48°C solution of triglycerol and is accompanied by an exotherm that is controllable by rate of addition. The mix becomes white as $Et_3N{\cdot}HCl$ is formed. A 14-mls THF sample is then used to rinse in all the acid chlorides. The reaction mixture is mixed for 2-hrs. The oil bath is then removed and the mixture is allowed to come to room temperature. The

cooled mixtures are concentrated by Rotavap to a solid and then dissolved in methylene chloride and filtered through Whatman #1 filter paper and Celite. The filtrate is then put into a 1-L separatory funnel and washed 2x with a saturated solution of NaCl and 1x with H_2O. The CH_2Cl_2 layer is dried with Na_2SO_4. The Na_2SO_4 from the resulting solution is filtered off and the remaining solution is then rotavaped to remove the CH_2Cl_2. A 36.5g sample of a waxy, white solid may be recovered for a 91% yield.

Example: Esterification of a Hexaglycerol C_{16}/C_{18} Triester to make the C_{16}/C_{18} Octaester

A 10.50g (0.009 mol) sample of hexaglycerol C16/C18 triester (Grindsted PGE 215, available from Danisco A/S, Denmark, is placed into a dry, 250-ml, 3-neck, round-bottom flask equipped with mechanical stirring, thermometer, condenser, and positive N_2. 35-mls of anhydrous THF is transferred by canula. The following is then added: 0.13g (0.001 mol) 4-(dimethylamino)pyridine (Alfa Aesar 99%) and 4.36g (0.043 mol) triethylamine (Aldrich) with a small amount of THF used to rinse in the Et_3N. The flask is then placed in an oil bath and taken to 48°C. 6.00g (0.022 mol) palmitoyl acid chloride (Aldrich, 98.5%) and 6.58g (0.022 mol) stearoyl acid chloride (TCI, 99%) are mixed into a 125-ml addition funnel with 30-mls THF. The solution of acid chlorides is then dripped into the 48°C solution of hexaglycerol triester accompanied by an exotherm that is controllable by rate of addition. The mix becomes white as $Et_3N{\cdot}HCl$ is formed. A small amount of THF is used to rinse in all the acid chlorides. After the resulting mixture mixes for approximately 4.5-hrs, the oil bath is removed, and the solution allowed to mix and cool to room temperature. The cooled mixture is concentrated by rotavap to a solid. The resulting solid is put in ether and filtered through Whatman #4 paper with Celite. The filtrate is placed into a separatory funnel and washed 2x with a saturated solution of NaCl and 1x with H_2O. The ether layer is dried with Na_2SO_4. The Na_2SO_4 is filtered off and then rotavaped to remove the ether. A 21.09g sample of a brittle, white solid is obtained for a 99% yield.

According to certain embodiments, the compositions comprising the mixture of polyglycerol esters may be any surface treatment or cleaning composition, such as, but not limited to, a fabric care composition, a dish cleaning composition, or a home surface care composition. Examples of treatment and cleaning compositions include, but are not limited to, liquid laundry detergents, solid laundry detergents, laundry soap products, laundry spray treatment products, laundry pre-treatment products, hand dish washing detergents, automatic dishwashing detergents, hard

surface cleaning detergents, carpet cleaning detergents, and a household cleaning detergent. Examples of fabric care compositions suitable for the present disclosure include, but are not limited to, liquid laundry detergents, heavy duty liquid laundry detergents, solid laundry detergents, laundry soap products, laundry spray treatment products, laundry pre-treatment products, laundry soak products, heavy duty liquid detergents, and rinse additives. Examples of suitable dish cleaning compositions include, but are not limited to, automatic dishwasher detergents, detergents for hand washing of dishes, liquid dish soap, and solid granular dish soap. Examples of suitable home care compositions include, but are not limited to, rug or carpet cleaning compositions, hard surface cleaning detergents, floor cleaning compositions, window cleaning compositions, toilet and bathroom cleaning compositions, household cleaning detergents, and car washing detergents.

Liquid Detergent Compositions

The treatment or cleaning compositions herein, such as, but not limited to liquid detergent compositions, may take the form of an aqueous solution or uniform dispersion or suspension of surfactant and water, polyorganosiloxane-silicone resin mixture, and certain optional adjunct ingredients, some of which may normally be in solid form, that have been combined with the normally liquid components of the composition. Suitable surfactants may be anionic, nonionic, cationic, zwitterionic and/or amphoteric surfactants. In one embodiment, the cleaning composition comprises anionic surfactant, nonionic surfactant, or mixtures thereof.

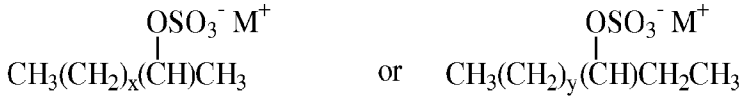
Suitable anionic surfactants may be any of the conventional anionic surfactant types typically used in cleaning compositions, such as liquid or solid detergent products. Such surfactants include the alkyl benzene sulfonic acids and their salts as well as alkoxylated or non-alkoxylated alkyl sulfate materials. Exemplary anionic surfactants are the alkali metal salts of C_{10}-C_{16} alkyl benzene sulfonic acids, preferably C_{11}-C_{14} alkyl benzene sulfonic acids. In one aspect, the alkyl group is linear. Such linear alkyl benzene sulfonates are known as "LAS". Such surfactants and their preparation are described for example in U.S. Patent Nos. 2,220,099 and 2,477,383. Especially preferred are the sodium and potassium linear straight chain alkylbenzene sulfonates in which the average number of carbon atoms in the alkyl group is from about 11 to 14. Sodium C_{11}-C_{14}, e.g., C_{12} LAS is a specific example of such surfactants.

Another exemplary type of anionic surfactant comprises ethoxylated alkyl sulfate surfactants. Such materials, also known as alkyl ether sulfates or alkyl polyethoxylate sulfates, are those which correspond to the formula: $R'\text{-}O\text{-}(C_2H_4O)_n\text{-}SO_3M$ wherein R' is a C_8-C_{20} alkyl

group, n is from about 1 to 20, and M is a salt-forming cation. In a specific embodiment, R' is C_{10}-C_{18} alkyl, n is from about 1 to 15, and M is sodium, potassium, ammonium, alkylammonium, or alkanolammonium. In more specific embodiments, R' is a C_{12}-C_{16}, n is from about 1 to 6, and M is sodium.

The alkyl ether sulfates will generally be used in the form of mixtures comprising varying R' chain lengths and varying degrees of ethoxylation. Frequently such mixtures will inevitably also contain some non-ethoxylated alkyl sulfate materials, i.e., surfactants of the above ethoxylated alkyl sulfate formula wherein n = 0. Non-ethoxylated alkyl sulfates may also be added separately to the cleaning compositions of this disclosure and used as or in any anionic surfactant component which may be present. Specific examples of non-alkoxylated, e.g., non-ethoxylated, alkyl ether sulfate surfactants are those produced by the sulfation of higher C_8-C_{20} fatty alcohols. Conventional primary alkyl sulfate surfactants have the general formula: $R"OSO_3^-M^+$ wherein R" is typically a linear C_8-C_{20} hydrocarbyl group, which may be straight chain or branched chain, and M is a water-solubilizing cation. In specific embodiments, R" is a C_{10}-C_{15} alkyl, and M is alkali metal, more specifically R" is C_{12}-C_{14} and M is sodium.

Specific, nonlimiting examples of anionic surfactants useful herein include: a) C_{11}-C_{18} alkyl benzene sulfonates (LAS); b) C_{10}-C_{20} primary, branched-chain and random alkyl sulfates (AS); c) C_{10}-C_{18} secondary (2,3)-alkyl sulfates having Formulae (V) and (VI):



(V) or (VI)

wherein M in Formulae (V) and (VI) is hydrogen or a cation which provides charge neutrality, and all M units, whether associated with a surfactant or adjunct ingredient, can either be a hydrogen atom or a cation depending upon the form isolated by the artisan or the relative pH of the system wherein the compound is used, with non-limiting examples of preferred cations including sodium, potassium, ammonium, and mixtures thereof, and x in Formula V is an integer of at least about 7, preferably at least about 9, and y in Formula VI is an integer of at least 8, preferably at least about 9; d) C_{10}-C_{18} alkyl alkoxy sulfates (AE_xS) wherein preferably x in Formula V is from 1-30; e) C_{10}-C_{18} alkyl alkoxy carboxylates preferably comprising 1-5 ethoxy units; f) mid-chain branched alkyl sulfates as discussed in U.S. Patent Nos. 6,020,303 and 6,060,443; g) mid-chain branched alkyl alkoxy sulfates as discussed in U.S. Patent Nos. 6,008,181 and 6,020,303; h) modified alkylbenzene sulfonate (MLAS) as discussed in WO

99/05243, WO 99/05242, WO 99/05244, WO 99/05082, WO 99/05084, WO 99/05241, WO 99/07656, WO 00/23549, and WO 00/23548.; i) methyl ester sulfonate (MES); and j) alpha-olefin sulfonate (AOS).

Suitable nonionic surfactants useful herein can comprise any of the conventional nonionic surfactant types typically used in liquid detergent products. These include alkoxylated fatty alcohols and amine oxide surfactants. Preferred for use in the liquid detergent products herein are those nonionic surfactants which are normally liquid. Suitable nonionic surfactants for use herein include the alcohol alkoxylate nonionic surfactants. Alcohol alkoxylates are materials which correspond to the general formula: $R^7(C_mH_{2m}O)_nOH$ wherein R^7 is a C_8-C_{16} alkyl group, m is from 2 to 4, and n ranges from about 2 to 12. Preferably R^7 is an alkyl group, which may be primary or secondary, that contains from about 9 to 15 carbon atoms, more preferably from about 10 to 14 carbon atoms. In one embodiment, the alkoxylated fatty alcohols will also be ethoxylated materials that contain from about 2 to 12 ethylene oxide moieties per molecule, more preferably from about 3 to 10 ethylene oxide moieties per molecule.

The alkoxylated fatty alcohol materials useful in the liquid detergent compositions herein will frequently have a hydrophilic-lipophilic balance (HLB) which ranges from about 3 to 17. More preferably, the HLB of this material will range from about 6 to 15, most preferably from about 8 to 15. Alkoxylated fatty alcohol nonionic surfactants have been marketed under the tradename NEODOL® by the Shell Chemical Company.

Another suitable type of nonionic surfactant useful herein comprises the amine oxide surfactants. Amine oxides are materials which are often referred to in the art as "semi-polar" nonionics. Amine oxides have the formula: $R'''(EO)_x(PO)_y(BO)_zN(O)(CH_2R')_2.qH_2O$. In this formula, R''' is a relatively long-chain hydrocarbyl moiety which can be saturated or unsaturated, linear or branched, and can contain from 8 to 20, preferably from 10 to 16 carbon atoms, and is more preferably C_{12}-C_{16} primary alkyl. R' is a short-chain moiety, preferably selected from hydrogen, methyl and $-CH_2OH$. When x + y + z is different from 0, EO is ethyleneoxy, PO is propyleneneoxy and BO is butyleneoxy. Amine oxide surfactants are illustrated by C_{12}-C_{14} alkyldimethyl amine oxide.

Non-limiting examples of nonionic surfactants include: a) C_{12}-C_{18} alkyl ethoxylates, such as, NEODOL® nonionic surfactants; b) C_6-C_{12} alkyl phenol alkoxylates wherein the alkoxylate units are a mixture of ethyleneoxy and propyleneoxy units; c) 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; d) C_{14}-C_{22} mid-chain branched alcohols, BA, as discussed in U.S. Patent No.

6,150,322; e) C_{14}-C_{22} mid-chain branched alkyl alkoxylates, $BAE_{x,}$ wherein x is 1-30, as discussed in U.S. Patent Nos. 6,153,577; 6,020,303; and 6,093,856; f) alkylpolysaccharides as discussed in U.S. Patent No. 4,565,647; specifically alkylpolyglycosides as discussed in U.S. Patent Nos. 4,483,780 and 4,483,779; g) polyhydroxy fatty acid amides as discussed in U.S. Patent No. 5,332,528; WO 92/06162; WO 93/19146; WO 93/19038; and WO 94/09099; and h) ether capped poly(oxyalkylated) alcohol surfactants as discussed in U.S. Patent No. 6,482,994 and WO 01/42408.

In the laundry detergent compositions and other cleaning compositions herein, the detersive surfactant component may comprise combinations of anionic and nonionic surfactant materials. When this is the case, the weight ratio of anionic to nonionic will typically range from 10:90 to 90:10, more typically from 30:70 to 70:30.

Cationic surfactants are well known in the art and non-limiting examples of these include quaternary ammonium surfactants, which can have up to 26 carbon atoms. Additional examples include a) alkoxylate quaternary ammonium (AQA) surfactants as discussed in U.S. Patent No. 6,136,769; b) dimethyl hydroxyethyl quaternary ammonium as discussed in U.S. Patent No. 6,004,922; c) polyamine cationic surfactants as discussed in WO 98/35002; WO 98/35003; WO 98/35004; WO 98/35005; and WO 98/35006; d) cationic ester surfactants as discussed in U.S. Patent Nos. 4,228,042; 4,239,660; 4,260,529; and 6,022,844; and e) amino surfactants as discussed in U.S. Patent No. 6,221,825 and WO 00/47708, specifically amido propyldimethyl amine (APA).

Non-limiting examples of zwitterionic surfactants include: derivatives of secondary and tertiary amines, derivatives of heterocyclic secondary and tertiary amines, or derivatives of quaternary ammonium, quaternary phosphonium or tertiary sulfonium compounds. See U.S. Patent No. 3,929,678 at column 19, line 38 through column 22, line 48, for examples of zwitterionic surfactants; betaine, including alkyl dimethyl betaine and cocodimethyl amidopropyl betaine, C_8-C_{18} (preferably C_{12}-C_{18}) amine oxides and sulfo and hydroxy betaines, such as N-alkyl-N,N-dimethylammino-1-propane sulfonate where the alkyl group can be C_8-C_{18}, preferably C_{10}-C_{14}.

Non-limiting examples of ampholytic surfactants include: aliphatic derivatives of secondary or tertiary amines, or aliphatic derivatives of heterocyclic secondary and tertiary amines in which the aliphatic radical can be straight- or branched-chain. One of the aliphatic substituents contains at least about 8 carbon atoms, typically from about 8 to about 18 carbon atoms, and at least one contains an anionic water-solubilizing group, e.g. carboxy, sulfonate,

sulfate. See U.S. Patent No. 3,929,678 at column 19, lines 18-35, for examples of ampholytic surfactants.

The cleaning compositions disclosed herein may 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 cleaning composition. In one aspect, 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 surfactant and the solid 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 described above, 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.

In another aspect of producing liquid cleaning compositions, the polyorganosiloxane-silicone resin mixture may first be combined with one or more liquid components to form a polyorganosiloxane-silicone resin mixturepolyorganosiloxane-silicone resin mixture premix, and this polyorganosiloxane-silicone resin mixturepolyorganosiloxane-silicone resin mixture premix is added to a composition formulation containing a substantial portion, for example more than 50% by weight, more than 70% by weight, or even more than 90% by weight, of the balance of components of the cleaning composition. For example, in the methodology described above, both the polyorganosiloxane-silicone resin mixturepolyorganosiloxane-silicone resin mixture premix and the enzyme component are added at a final stage of component additions. In another aspect, the polyorganosiloxane-silicone resin mixturepolyorganosiloxane-silicone resin mixture is encapsulated prior to addition to the detergent composition, the encapsulated polyorganosiloxane-silicone resin mixturepolyorganosiloxane-silicone resin mixture is suspended

in a structured liquid, and the suspension is added to a composition formulation containing a substantial portion of the balance of components of the cleaning composition.

Example 3 - Heavy Duty Liquid Laundry Detergent Formulation

In this Example, three sample formulations for a heavy duty liquid (HDL) laundry detergent are prepared using the polyorganosiloxane-silicone resin mixture according to embodiments of the present disclosure. The polyorganosiloxane-silicone resin mixture is added to the formulations in an amount ranging from 0.5% to 2.0% by weight.

Ingredient	**A Wt %**	**B Wt %**	**C Wt %**	**D Wt%**	**E Wt%**
Sodium alkyl ether sulfate	20.5	20.5	20.5		
C12-15 Alkyl Polyethoxylate (1.1) Sulfonic Acid				9.0	
Branched alcohol sulfate	5.8	5.8	5.8		
Linear alkylbenzene sulfonic acid	2.5	2.5	2.5	1.0	8.0
Alkyl ethoxylate	0.8	0.8	0.8	1.5	6.0
Amine oxide	0	0.5	2		1.0
Citric acid	3.5	3.5	3.5	2.0	2.5
Fatty acid	2.0	2.0	2.0		5.5
Protease	0.7	0.7	0.7	0.4	0.4
Amylase	0.37	0.37	0.37	0.08	0.08
Mannanase				0.03	0.03
Borax (38%)	3.0	3.0	3.0	1.0	
MEA Borate					1.5
Calcium and sodium formate	0.22	0.22	0.22	0.7	
Amine ethoxylate polymers	1.2	0.5	1.0	1.0	1.5
Zwitterionic amine ethoxylate polymer	1.0	2.0	1.0		
PGE-1[a]	3.0	3.0	6.0	6.0	0.0
PGE-2 [b]	0.0	0.0	0.0	0.0	3.0
DTPA[c]	0.25	0.25	0.25	0.3	0.3
Fluorescent whitening agent	0.2	0.2	0.2		
Ethanol	2.9	2.9	2.9	1.5	1.5
Propylene Glycol				3.0	5.0
Propanediol	5.0	5.0	5.0		
Diethylene glycol	2.56	2.56	2.56		
Polyethylene glycol 4000	0.11	0.11	0.11		
Monoethanolamine	2.7	2.7	2.7	1.0	0.5
Sodium hydroxide (50%)	3.67	3.67	3.67	1.4	1.4
Sodium cumene sulfonate	0	0.5	1		0.7
Silicone suds suppressor	0.01	0.01	0.01		0.02
Perfume	0.5	0.5	0.5	0.30	0.3
Dye	0.01	0.01	0.01	0.016	0.016
Opacifier[d]	0.01	0.01	0.01		
Water	balance	balance	balance	balance	balance
	100.0%	100.0%	100.0%	100.0%	100.0%

[a] PGE-1 = Polyglycerol Ester with average glycerol chain length of 3, average esterification of 2, Tallow Fatty Acid and a polydispersity index of 112.5

[b] PGE-2 = Polyglycerol Ester with average glycerol chain length of 3.4, average esterification of 3.4, Tallow Fatty Acid and a polydispersity index of 142.34

[c] Diethylenetriaminepentaacetic acid, sodium salt

[d] Acusol OP 301

Formulation Example	F	G	H	I	J	K	L
Ingredient	Wt %						
PGE-1[a]	3	3	6	6	0	0	0
PGE-2 [b]	0	0	0	0	3	3	6
Perfume	1.5	1.5	1.5	1.5	1.5	1.5	1.5
Deposition agent-2 [f]	0.5	0	0.5	0	0.5	0	0.5
Deposition agent-3 [g]	0	0.5	0	0.5	0	0.5	0
NI 45-8 [t]	6.25	6.25	6.25	6.25	6.25	6.25	6.25
AES [u]	10.6	10.6	10.6	10.6	10.6	10.6	10.6
Citric Acid	4.72	4.72	4.72	4.72	4.72	4.72	4.72
HLAS [v]	0.78	0.78	0.78	0.78	0.78	0.78	0.78
TPK FA [w]	8.75	8.75	8.75	8.75	8.75	8.75	8.75
Zwitterionic Ethylene Diamine [x]	1.4	1.4	1.4	1.4	1.4	1.4	1.4
DTPMP [y]	0.21	0.21	0.21	0.21	0.21	0.21	0.21
Ethanol	2.75	2.75	2.75	2.75	2.75	2.75	2.75
Boric Acid	2.39	2.39	2.39	2.39	2.39	2.39	2.39
Sodium Hydroxide	5.79	5.79	5.79	5.79	5.79	5.79	5.79
Water	Balance to 100%						

[a] PGE-1 = Polyglycerol Ester with average glycerol chain length of 3, average esterification of 2, Tallow Fatty Acid and a polydispersity index of 112.5

[b] PGE-2 = Polyglycerol Ester with average glycerol chain length of 3.4, average esterification of 3.4, Tallow Fatty Acid and a polydispersity index of 142.34

[s] NI 45- 8 = alcohol ethoxylate with an approximate average chainlength of C14, C15 and an average of 8 ethoxylates.

[t] AES = alkyl ethoxylate sulfate

[u] HLAS = H linear alkylbenzene solfonate

[v] TPK FA = Tall Palm Kernel Fatty Acid

[w] As described in WO01/62882 and 6,444,633 (Quaternized trans sulfated hexamethylenediamine)

[x] DTPMP = diethylene triamine penta(methyl Phosphonic) acid

Granular Laundry Detergent Compositions

In another aspect of the present disclosure, the fabric care compositions disclosed herein, may take the form of granular laundry detergent compositions. Such compositions comprise the dispersant polymer of the present disclosure to provide soil and stain removal and anti-redeposition, suds boosting, and/or soil release benefits to fabric washed in a solution containing the detergent. Typically, the granular laundry detergent compositions are used in washing solutions at a level of from about 0.0001% to about 0.05%, or even from about 0.001% to about 0.01% by weight of the washing solution.

Detergent compositions may be in the form of a granule. Typical components of granular detergent compositions include but are not limited to surfactants, builders, bleaches, bleach activators and/or other bleach catalysts and/or boosters, enzymes, enzyme stabilizing agents, soil suspending agents, soil release agents, pH adjusting agents and/or other electrolytes, suds boosters or suds suppressers, anti-tarnish and anticorrosion agents, non-builder alkalinity sources, chelating agents, organic and inorganic fillers, solvents, hydrotropes, clays, silicones, flocculant, dye transfer inhibitors, photobleaches, fabric integrity agents, effervesence-generating agents, processing aids (non-limiting examples of which include binders and hydrotropes), germicides, brighteners, dyes, and perfumes. Granular detergent compositions typically comprise from about 1% to 95% by weight of a surfactant. Detersive surfactants utilized can be of the anionic, nonionic, cationic, zwitterionic, ampholytic, amphoteric, or catanionic type or can comprise compatible mixtures of these types.

Granular detergents can be made by a wide variety of processes, non-limiting examples of which include spray drying, agglomeration, fluid bed granulation, marumarisation, extrusion, or a combination thereof. Bulk densities of granular detergents generally range from about 300 g/l - 1000 g/l. The average particle size distribution of granular detergents generally ranges from about 250 microns - 1400 microns.

Granular detergent compositions of the present disclosure may include any number of conventional detergent ingredients. For example, the surfactant system of the detergent composition may include anionic, nonionic, zwitterionic, ampholytic and cationic classes and compatible mixtures thereof. Detergent surfactants for granular compositions are described in U.S. Patent Nos. 3,664,961 and 3,919,678. Cationic surfactants include those described in U.S. Patent Nos. 4,222,905 and 4,239,659.

Non-limiting examples of surfactant systems include the conventional C_{11}-C_{18} alkyl benzene sulfonates ("LAS") and primary, branched-chain and random C_{10}-C_{20} alkyl sulfates

("AS"), the C_{10}-C_{18} secondary (2,3) alkyl sulfates of the formula $CH_3(CH_2)_x(CHOSO_3^-M^+)CH_3$ and $CH_3(CH_2)_y(CHOSO_3^-M^+)CH_2CH_3$ where x and (y + 1) are integers of at least about 7, preferably at least about 9, and M is a water-solubilizing cation, especially sodium, unsaturated sulfates such as oleyl sulfate, the C_{10}-C_{18} alkyl alkoxy sulfates ("AE_xS"; especially EO 1-7 ethoxy sulfates), C_{10}-C_{18} alkyl alkoxy carboxylates (especially the EO 1-5 ethoxycarboxylates), the C_{10}-C_{18} glycerol ethers, the C_{10}-C_{18} alkyl polyglycosides and their corresponding sulfated polyglycosides, and C_{12}-C_{18} alpha-sulfonated fatty acid esters. If desired, the conventional nonionic and amphoteric surfactants such as the C_{12}-C_{18} alkyl ethoxylates ("AE") including the so-called narrow peaked alkyl ethoxylates and C_6-C_{12} alkyl phenol alkoxylates (especially ethoxylates and mixed ethoxy/propoxy), C_{12}-C_{18} betaines and sulfobetaines ("sultaines"), C_{10}-C_{18} amine oxides, and the like, can also be included in the surfactant system. The C_{10}-C_{18} N-alkyl polyhydroxy fatty acid amides can also be used. See WO 92/06154. Other sugar-derived surfactants include the N-alkoxy polyhydroxy fatty acid amides, such as C_{10}-C_{18} N-(3-methoxypropyl) glucamide. The N-propyl through N-hexyl C_{12}-C_{18} glucamides can be used for low sudsing. C_{10}-C_{20} conventional soaps may also be used. If high sudsing is desired, the branched-chain C_{10}-C_{16} soaps may be used. Mixtures of anionic and nonionic surfactants are especially useful. Other conventional useful surfactants are listed in standard texts.

The cleaning composition can, and in certain embodiments preferably does, include a detergent builder. Builders are generally selected from the various water-soluble, alkali metal, ammonium or substituted ammonium phosphates, polyphosphates, phosphonates, polyphosphonates, carbonates, silicates, borates, polyhydroxy sulfonates, polyacetates, carboxylates, and polycarboxylates. Preferred are the alkali metals, especially sodium, salts of the above. Preferred for use herein are the phosphates, carbonates, silicates, C_{10}-C_{18} fatty acids, polycarboxylates, and mixtures thereof. More preferred are sodium tripolyphosphate, tetrasodium pyrophosphate, citrate, tartrate mono- and di-succinates, sodium silicate, and mixtures thereof.

Specific examples of inorganic phosphate builders are sodium and potassium tripolyphosphate, pyrophosphate, polymeric metaphosphate having a degree of polymerization of from about 6 to 21, and orthophosphates. Examples of polyphosphonate builders are the sodium and potassium salts of ethylene diphosphonic acid, the sodium and potassium salts of ethane 1-hydroxy-1,1-diphosphonic acid and the sodium and potassium salts of ethane-1,1,2-triphosphonic acid. Other phosphorus builder compounds are disclosed in U.S. Patent Nos. 3,159,581; 3,213,030; 3,422,021; 3,422,137; 3,400,176; and 3,400,148. Examples of non-phosphorus,

inorganic builders are sodium and potassium carbonate, bicarbonate, sesquicarbonate, tetraborate decahydrate, and silicates having a weight ratio of SiO_2 to alkali metal oxide of from about 0.5 to about 4.0, preferably from about 1.0 to about 2.4. Water-soluble, non-phosphorus organic builders useful herein include the various alkali metal, ammonium and substituted ammonium polyacetates, carboxylates, polycarboxylates and polyhydroxy sulfonates. Examples of polyacetate and polycarboxylate builders are the sodium, potassium, lithium, ammonium and substituted ammonium salts of ethylene diamine tetraacetic acid, nitrilotriacetic acid, oxydisuccinic acid, mellitic acid, benzene polycarboxylic acids, and citric acid.

Polymeric polycarboxylate builders are set forth in U.S. Patent No. 3,308,067. Such materials include the water-soluble salts of homo- and copolymers of aliphatic carboxylic acids such as maleic acid, itaconic acid, mesaconic acid, fumaric acid, aconitic acid, citraconic acid and methylenemalonic acid. Some of these materials are useful as the water-soluble anionic polymer as hereinafter described, but only if in intimate admixture with the non-soap anionic surfactant. Other suitable polycarboxylates for use herein are the polyacetal carboxylates described in U.S. Patent Nos. 4,144,226 and 4,246,495.

Water-soluble silicate solids represented by the formula $SiO_2 \bullet M_2O$, M being an alkali metal, and having a $SiO_2:M_2O$ weight ratio of from about 0.5 to about 4.0, are useful salts in the detergent granules of this disclosure at levels of from about 2% to about 15% on an anhydrous weight basis. Anhydrous or hydrated particulate silicate can be utilized, as well.

Various techniques for forming cleaning compositions in such solid forms are well known in the art and may be used herein. In one aspect, when the cleaning composition, such as a fabric care composition, is in the form of a granular particle, the polyorganosiloxane-silicone resin mixture is provided in particulate form, optionally including additional but not all components of the cleaning composition. The polyorganosiloxane-silicone resin mixture particulate is combined with one or more additional particulates containing a balance of components of the cleaning composition. Further, the polyorganosiloxane-silicone resin mixture, optionally including additional but not all components of the cleaning composition may be provided in an encapsulated form, and the polyorganosiloxane-silicone resin mixture encapsulate is combined with particulates containing a substantial balance of components of the cleaning composition.

Example 4 - Powder Laundry Detergent Formulation

In this Example, four sample formulations for a powder laundry detergent are prepared using the polysiloxane-silicone resin mixture according to embodiments of the present disclosure.

The polyorganosiloxane-silicone resin mixture is added to the formulations in an amount ranging from 1.0% to 3.0% by weight.

Ingredients	A Wt. %	B Wt.%	C Wt. %	D Wt.%
Sodium alkylbenzenesulfonate	16.0000	14.0000	12.0000	7.9
Sodium alkyl alcohol ethoxylate (3) sulfate	-	-	-	4.73
Sodium mid-cut alkyl sulfate		1.5000	1.5000	-
Alkyl dimethyl hydroxyethyl quaternary amine (chloride)	-	-	-	0.5
Alkyl ethoxylate	1.3000	1.3000	1.3000	--
Polyamine[1]	-	-	-	0.79
Nonionic Polymer[2]	1.0000	1.0000	1.0000	1.0
Carboxymethylcellulose	0.2000	0.2000	0.2000	1.0
Sodium polyacrylate	--	--	--	--
Sodium polyacrylate / maleate polymer	0.7000	0.7000	0.7000	3.5
PGE-1[a]	3	3	6	6
PGE-2 [b]	0	0	0	0
Sodium tripolyphosphate	10.0000	5.0000	--	--
Zeolite	16.0000	16.0000	16.0000	--
Citric Acid	--	--	--	5.0
Sodium Carbonate	12.5000	12.5000	12.5000	25.0
Sodium Silicate	4.0	4.0	4.0	--
Enzymes[3]	0.30	0.30	0.30	0.5
Minors including moisture[4]	balance	balance	balance	balance

[1]Hexamethylenediamine ethoxylated to 24 units for each hydrogen atom bonded to a nitrogen, quaternized.

[2]Comb polymer of polyethylene glycol and polyvinylacetate

[3]Enzyme cocktail selected from known detergent enzymes including amylase, cellulase, protease, and lipase.

[4]Balance to 100% can, for example, include minors like optical brightener, perfume, suds suppresser, soil dispersant, soil release polymer, chelating agents, bleach additives and boosters, dye transfer inhibiting agents, aesthetic enhancers (example: Speckles), additional water, and fillers, including sulfate, $CaCO_3$, talc, silicates, etc.

[a] PGE-1 = Polyglycerol Ester with average glycerol chain length of 3, average esterification of 2, Tallow Fatty Acid and a polydispersity index of 112.5

[b] PGE-2 = Polyglycerol Ester with average glycerol chain length of 3.4, average esterification of 3.4, Tallow Fatty Acid and a polydispersity index of 142.34

Example 5 – Automatic Dishwasher Detergent Formulation

In this Example, five sample formulations for an automatic dishwasher detergent are prepared using the polyorganosiloxane-silicone resin mixture according to embodiments of the present disclosure. The polyorganosiloxane-silicone resin mixture is added to the formulations in an amount ranging from 0.05% to 15% by weight.

Ingredients	A Wt. %	B Wt.%	C Wt. %	D Wt.%	E Wt.%
Polymer dispersant[1]	0.5	5	6	5	5
Carbonate	35	40	40	35-40	35-40
Sodium tripolyphosphate	0	6	10	0-10	0-10
Silicate soilds	6	6	6	6	6
Bleach and Bleach activators	4	4	4	4	4
Enzymes	0.3-0.6	0.3-0.6	0.3-0.6	0.3-0.6	0.3-0.6
Disodium citrate dihydrate	0	0	0	2-20	0
Nonionic surfactant[2]	0	0	0	0	0.8-5
PGE-1[a]	3	3	6	6	6
PGE-2 [b]	0	0	0	0	
Water, sulfate, perfume, dyes and other adjuncts	Balance to 100%	Balance to 100%	Balance to 100%	Balance to 100%	Balance to 100%

[1]Anionic polymers such as Acusol, Alcosperse and other modified polyacrylic acid polymers.

[2]Such as SLF-18 polytergent from Olin Corporation

[a] PGE-1 = Polyglycerol Ester with average glycerol chain length of 3, average esterification of 2, Tallow Fatty Acid and a polydispersity index of 112.5

[b] PGE-2 = Polyglycerol Ester with average glycerol chain length of 3.4, average esterification of 3.4, Tallow Fatty Acid and a polydispersity index of 142.34

Liquid Dishwashing Liquid

Example XXIII - Liquid Dish Handwashing Detergents

Composition	A	B
C_{12-13} Natural AE0.6S	270	240
C_{10-14} mid-branched Amine Oxide	--	6.0
Poly-branched Alcohol Ethoxylate according to SYNTHETIC EXAMPLES XIII through XX	2.0	5.0
C_{12-14} Linear Amine Oxide	6.0	--
SAFOL® 23 Amine Oxide	1.0	1.0
$C_{11}E_9$ Nonionic [1]	2.0	2.0
Ethanol	4.5	4.5
Sodium cumene sulfonate	1.6	1.6
Polypropylene glycol 2000	0.8	0.8
NaCl	0.8	0.8
1,3 BAC Diamine[2]	0.5	0.5

PGE-1[a]	3	0
PGE-2[b]	0	6
Water	Balance	Balance

[1] Nonionic may be either C_{11} Alkyl ethoxylated surfactant containing 9 ethoxy groups.

[2]1,3, BAC is 1,3 bis(methylamine)-cyclohexane.

[a] PGE-1 = Polyglycerol Ester with average glycerol chain length of 3, average esterification of 2, Tallow Fatty Acid and a polydispersity index of 112.5

[b] PGE-2 = Polyglycerol Ester with average glycerol chain length of 3.4, average esterification of 3.4, Tallow Fatty Acid and a polydispersity index of 142.34

Unit Dose

The detergent product of the present invention is a water-soluble pouch, more preferably a multi-compartment water-soluble pouch. The pouch comprises a water-soluble film and at least a first, and optionally a second compartment. The first compartment comprises a first composition, comprising an opacifier and an antioxidant. The second compartment comprises a second compartment. Preferably the pouch comprises a third compartment and a third composition. The optionally second and third compositions are preferably visibly distinct from each other and the first composition.

A difference in aesthetic appearance can be achieved in a number of ways, however the first compartment of the present pouch comprises an opaque liquid composition. The compartments of the pouch may be the same size or volume. Alternatively, the compartments of the pouch may have different sizes, with different internal volumes. The compartments may also be different from one another in terms of texture. Hence one compartment may be glossy, whilst the other is matt. This can be readily achieved as one side of a water-soluble film is often glossy, whilst the other has a matt finish. Alternatively the film used to make a compartment may be treated in a way so as to emboss, engrave or print the film. Embossing may be achieved by adhering material to the film using any suitable means described in the art. Engraving may be achieved by applying pressure onto the film using any suitable technique available in the art. Printing may be achieved using any suitable printer and process available in the art. Alternatively, the film itself may be coloured, allowing the manufacturer to select different coloured films for each compartment. Alternatively the films may be transparent or translucent and the composition contained within may be coloured. Thus in a preferred embodiment of the present invention the first compartment contains an opaque product, coloured any colour selected from the group consisting of white, green, blue, orange, red, yellow, pink or purple, preferably white. The

second and subsequent compartment preferably has a different colour and is coloured a colour selected from the group consisting of yellow, orange, pink, purple, blue or green, more preferably green or blue. In one embodiment the multi-compartment pouch comprises a first compartment which is opaque and white and second and third compartments which are coloured toning colours of green or blue.

The compartments of the present multi-compartment pouches can be separate, but are preferably conjoined in any suitable manner. Most preferably the second and optionally third or subsequent compartments are superimposed on the first compartment. In one embodiment, the third compartment may be superimposed on the second compartment, which is in turn superimposed on the first compartment in a sandwich configuration. Alternatively the second and third compartments are superimposed on the first compartment. However it is also equally envisaged that the first, second and optionally third and subsequent compartments may be attached to one another in a side by side relationship. The compartments may be packed in a string, each compartment being individually separable by a perforation line. Hence each compartment may be individually torn-off from the remainder of the string by the end-user, for example, so as to pre-treat or post-treat a fabric with a composition from a compartment.

In a preferred embodiment the present pouch comprises three compartments consisting of a large first compartment and two smaller compartments. The second and third smaller compartments are superimposed on the first larger compartment. The size and geometry of the compartments are chosen such that this arrangement is achievable.

The geometry of the compartments may be the same or different. In a preferred embodiment the second and optionally third compartment have a different geometry and shape to the first compartment. In this embodiment the second and optionally third compartments are arranged in a design on the first compartment. Said design may be decorative, educative, illustrative for example to illustrate a concept or instruction, or used to indicate origin of the product. In a preferred embodiment the first compartment is the largest compartment having two large faces sealed around the perimeter. The second compartment is smaller covering less than 75%, more preferably less than 50% of the surface area of one face of the first compartment. In the embodiment wherein there is a third compartment, the above structure is the same but the second

and third compartments cover less than 60%, more preferably less than 50%, even more preferably less than 45% of the surface area of one face of the first compartment.

The pouch is preferably made of a film material which is soluble or dispersible in water, and has a water-solubility 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 pouch materials are polymeric materials, preferably polymers which are formed into a film or sheet. The pouch material can, for example, be obtained 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 pouch materials are PVA films known under the trade reference Monosol M8630, as sold by Chris-Craft Industrial Products of Gary, Indiana, US, and PVA films of corresponding solubility and deformability characteristics. Other films suitable for use herein include films known under the trade reference PT film or the K-series of films supplied by Aicello, or VF-HP film supplied by Kuraray.

The pouch 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.

For reasons of deformability pouches or pouch compartments containing a component which is liquid will preferably contain an air bubble having a volume of up to about 50%, preferably up to

about 40%, more preferably up to about 30%, more preferably up to about 20%, more preferably up to about 10% of the volume space of said compartment.

Process for Making the Water-Soluble Pouch

The process of the present invention may be made using any suitable equipment and method. Single compartment pouches are made using vertical, but preferably horizontal form filling techniques commonly known in the art. The film is preferably dampened, 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.

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 (preferably 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 film, preferably water-soluble film, over and onto the open pouches and then preferably sealing the first 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.

Detergent Composition

The first composition of the present invention is a liquid. By the term 'liquid' it is meant to include liquid, paste, waxy or gel compositions. The liquid composition may comprise a solid. Solids may include powder or agglomerates, such as micro-capsules, beads, noodles or one or more pearlised balls or mixtures thereof. Such a solid element may provide a technical benefit, through the wash or as a pre-treat, delayed or sequential release component. Alternatively it may provide an aesthetic effect.

The first compartment comprises the main wash detergent composition. Said composition comprises an opacifier and antioxidant. Second and third compositions, where present preferably comprise a colouring agent and do not comprise an opacifier. The weight ratio of the first to second or third liquid compositions, where present, is preferably from 1: 1 to 20:1, more preferably from 2:1 to 10:1. The weight ratio of the second to third composition, where present, is from 1: 5 to 5:1, more preferably 1:2 to 2:1. Most preferably the weight ratio of second to third composition is 1:1

The construction of the multi-compartment pouch according to the present invention provides benefits in terms of aesthetic appeal. A further benefit of said construction is the ability to separate, otherwise incompatible, ingredients. In a preferred aspect of the present invention, the first composition comprises an opacifier. Second and/or third compositions are preferably darker than the first composition.

Other ingredients that could preferably be separated include whitening agents that are sensitive to other constituents of the composition. For example triphenyl methane whitening agents are sensitive to pH, becoming unstable in compositions with pH greater than 9 and Thiazolium whitening agents are not stable in the presence of perfumes. The pH of the composition containing the whitening agent could thus be separated from the main detergent ingredients comprising a higher pH and perfume. Equally cationic species are incompatible with an overtly anionic composition. Hence for example when a composition comprises high levels of anionic surfactants, cationic surfactants, which provide improved cleaning, or polymers such as deposition aids, can be separated into a different compartment. A bleach system or components of a bleaching system may be other ingredients that could be successfully separated from the main detergent composition. Bleach systems are difficult to formulate in liquid environments as the bleach becomes unstable and/or degrades.

Unit Dose composition

	Wt %
Glycerol (min 99)	5.3
1,2-propanediol	10.0
Citric Acid	0.5
Monoethanolamine	10.0
Caustic soda	-
Dequest 2010	1.1
Potassium sulfite	0.2

Nonionic Marlipal C24EO7	20.1
HLAS	24.6
Optical brightener FWA49	0.2
PGE-1[a]	6.0
C12-15 Fatty acid	16.4
Polymer Lutensit Z96	2.9
Polyethyleneimine ethoxylate PEI600 E20	1.1
MgCl2	0.2
Enzymes	ppm

[a] PGE-1 = Polyglycerol Ester with average glycerol chain length of 3, average esterification of 2, Tallow Fatty Acid and a polydispersity index of 112.5

Fabric Softeners - Liquids

Liquid fabric softening compositions (such as those marked under the brand name DOWNY) comprise a fabric softening active. One class of fabric softener actives includes cationic surfactants. Examples of cationic surfactants include quaternary ammonium compounds. Exemplary quaternary ammonium compounds include alkylated quaternary ammonium compounds, ring or cyclic quaternary ammonium compounds, aromatic quaternary ammonium compounds, diquaternary ammonium compounds, alkoxylated quaternary ammonium compounds, amidoamine quaternary ammonium compounds, ester quaternary ammonium compounds, and mixtures thereof. A final fabric softening composition (suitable for retail sale) will comprise from about 1% to about 30%, alternatively from about 10% to about 25%, alternatively from about 15 to about 20%, alternatively from about 0.1% to about 5%, alternatively combinations thereof, of fabric softening active by weight of the final composition. Fabric softening compositions, and components thereof, are generally described in US 2004/0204337. In one embodiment, the fabric softening composition is a so called rinse added composition. In such embodiment, the composition is substantially free of detersive surfactants, alternatively substantially free of anionic surfactants. In another embodiment, the pH of the fabric softening composition is acidic, for example between pH 2 and 4. In yet another embodiment, the fabric softening active is DEEDMAC (e.g., ditallowoyl ethanolester dimethyl ammonium chloride). DEEDMAC means mono and di-fatty acid ethanol ester dimethyl ammonium quaternaries, the reaction products of straight chain fatty acids, methyl esters and/or triglycerides (e.g., from animal and/or vegetable fats and oils such as tallow, palm oil and the like) and methyl diethanol amine to form the mono and di-ester compounds followed by quaternization with an aklyating agent. *See* U.S. Pat. Nos.: 4,767,547; 5,460,736; 5,474,690;

5,545,340; 5,545,350; 5,562,849. A suitable supplier of fabric softening active may include Evonik Degussa Corporation.

Adjunct ingredients that may be added to the fabric enhancer compositions of the present invention. The ingredients may include: suds suppressor, preferably a silicone suds suppressor (US 2003/0060390 A1, ¶ 65-77)l cationic starches (US7,135,451; US 7,625,857); scum dispersants (US 2003/0126282 A1, ¶89 – 90); perfume and perfume microcapsules (US 5,137,646); nonionic surfactant, non-aqueous solvent, fatty acid, dye, preservatives, optical brighteners, antifoam agents, and combinations thereof. Other adjunct ingredients may include: dispersing agent, stabilizer, pH control agent, metal ion control agent, colorant, brightener, dye, odor control agent, pro-perfume, cyclodextrin, solvent, soil release polymer, preservative, antimicrobial agent, chlorine scavenger, enzyme, anti-shrinkage agent, fabric crisping agent, spotting agent, anti-oxidant, anti-corrosion agent, bodying agent, drape and form control agent, smoothness agent, static control agent, wrinkle control agent, sanitization agent, disinfecting agent, germ control agent, mold control agent, mildew control agent, antiviral agent, anti-microbial, drying agent, stain resistance agent, soil release agent, malodor control agent, fabric refreshing agent, chlorine bleach odor control agent, dye fixative, dye transfer inhibitor, color maintenance agent, color restoration/rejuvenation agent, anti-fading agent, whiteness enhancer, anti-abrasion agent, wear resistance agent, fabric integrity agent, anti-wear agent, and rinse aid, UV protection agent, sun fade inhibitor, insect repellent, anti-allergenic agent, enzyme, flame retardant, water proofing agent, fabric comfort agent, water conditioning agent, shrinkage resistance agent, stretch resistance agent, enzymes, cationic starch, and combinations thereof. In one embodiment, the composition comprises one or more adjunct ingredient up to about 2% by weight of the composition. In yet another embodiment, the composition of the present invention may be free or essentially free of any one or more adjunct ingredients. In yet another embodiment, the composition is free or essentially free of detersive surfactants.

Another aspect of the invention provides for a dryer bar composition. Non-limiting examples of such compositions and articles are described in U.S. Pat. Nos.: 6,779,740; 6,883,723; 6,899,281; 6,908,041; 6,910,640; 6,910,641; 7,055,761; 7,087,572; 7,093,772; 7,250,393 ; 7,309,026; 7,381,697; 7,452,855; 7,456,145.

Another aspect of the invention provides for a dryer sheet coat mix composition. Non-limiting example of such compositions and dryer sheet articles are described in U.S Pat. Nos.: 5,929,026; 5,883,069; 5,574,179; 5,562,849; 5,545,350; 5,545,340; 5,476,599; 5,470,492; 4,981,239; 4,767,547.

Another aspect of the invention provides for a fabric spray composition. Non-limiting example of such compositions and articles are described in U.S Pat. Nos: 5,798,107; 6,001,343; 6,491,840; 6,495,058; 6,573,233. Method of treating fabric comprises the step of spraying a composition with a fabric spray composition.

Table I: Rinse-Added Compositions Examples 1-7.

Component Material	1	2	3	4	5	6	7
	Wt%						
PGE-1[a]	10	10	0	0	20	0	0
PGE-2[b]	0	0	10	10	0	14	14
CTMAC[c]	2	2	2	2	3	3	3
Silicone-1[d]	0	5	0	5	2	2.5	0
Silicone-2[e]	5	0	5	0	0	0	2.5
Tergitol TMN-6[f]	1.4	1.4	1.4	1.4	2	1	1
Perfume	1.5	1.5	1.5	1.5	1.5	1.5	1.5
Deposition agent-1[g]	2	0	0	0	0	0	0
Deposition agent-2[h]	0.5	0.5	0	0	0.5	0.5	0.5
Deposition agent-3[i]	0	0	0.5	0	0	0	0
Deposition agent-4[j]	0	0	0	0.5	0	0	0
Lactic acid	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Proxel[k]	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Dantoguard[l]	0.15	0.15	0.15	0.15	0.15	0.15	0.15
TMBA[m]	0.05	0.05	0.05	0.05	0.05	0.05	0.05
DPTA[n]	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Water	Balance to 100%						

[a] [a] PGE-1 = Polyglycerol Ester with average glycerol chain length of 3, average esterification of 2, Tallow Fatty Acid and a polydispersity index of 112.5

[b] PGE-2 = Polyglycerol Ester with average glycerol chain length of 3.4, average esterification of 3.4, Tallow Fatty Acid and a polydispersity index of 142.34

[c] CTMAC = Cetyl Trimethyl Ammonium Chloride

[d] Silicone-1 = SLM-21200 from Wacker Silicones

[e] Silicone-2= KF-873 from Shin-Etsu Silicones

[f] Nonionic surfactant derived from 2,6,8-trimethyl-4-nonanol with ethylene oxide.

[g] Catatonically modified starch from National Starch

[h] Polyvinylamine (PVAm) from BASF

[i] Polytheylenimine (PEI) from BASF

[j] Polyacrylamide Methacrylate amidopropyl/Trimethylammonium Chloride (PAM/MAPTAC) from NALCO

[k] Proxel = 1,2 Benzisothiozolin-3-one

[l] Dantoguard = Dimethylol-5,5-Dimethylhydanotoin

[m] TMBA = Trimethoxy Benzoic Acid

[n] DTPA = Sodium Diethylene Triamine Pentaacetate from NALCO

Table II: Rinse-Added Compositions Examples 8-12

Ingredient	8	9	10	11	12
	(wt %)	(wt %)	(wt %)	(wt %)	(wt %)
PGE-1[a]	10	10	10	0	0
PGE-2[b]	0	0	0	10	10
CTMAC[c]	3	3	3	3	3
Tergitol TMN-6[d]	2	2	2	2	2
Perfume	1.5	1.5	1.5	1.5	1.5
Deposition agent-1[e]	0	0	0	0.25	0
Deposition agent-3[g]	0.25	0.25	0.25	0	0.25
DEEDMAC[m]	0	5	0	0	0
DTDMAC[n]	5	0	0	0	0
TEA QUAT 1[o]	0	0	0	5	5
Glycerin	0	0	5	0	0
Lactic acid	0.5	0.5	0.5	0.5	0.5
Proxel[i]	0.1	0.1	0.1	0.1	0.1
Dantoguard[J]	0.15	0.15	0.15	0.15	0.15
TMBA[k]	0.05	0.05	0.05	0.05	0.05
DPTA[l]	0.05	0.05	0.05	0.05	0.05
HCl[p]	0.03	0.03	0.03	0.03	0.03
DC2310[q]	0.15	0.15	0.15	0.15	0.15
CaCl2[r]	0.59	0.59	0.59	0.59	0.59
Kathon[s]	0.03	0.03	0.03	0.03	0.03
Water	Balance to 100%				

[a,b,c,d,e,f,I,j,k, and l] are the same as the above examples

[m] DTDMAC = Di-Tallow Di-Methyl Ammonium Chloride

[n] DEEDMAC = Di-tallowoylethanolester dimethylammonium chloride

[o] TEA QUAT 1 = N,N-di(canolyl-oxy-ethyl)-N-methyl-N-(2-hydroxyethyl) ammonium methyl sulfate

[p]HCL = Hydrochloric Acid

[q] DC2310 = Silicone sud-suppressor from Dow Corning

[r] CaCl2 = Calcium Chloride

[s] Kathon = mixture of 5-chloro-2-methyl-4-isothiazolin-3-one and 2-methyl-4-isothiazolin-3-one

Processes of Making Cleaning Compositions

The cleaning compositions, such as, but not limited to, the fabric care compositions of the present disclosure can be formulated into any suitable form and prepared by any process chosen by the formulator, non-limiting examples of which are described in U.S. Patent Nos. 5,879,584; 5,691,297; 5,574,005; 5,569,645; 5,565,422; 5,516,448; 5,489,392; and 5,486,303.

Methods of Using Fabric Care Compositions

The fabric care compositions disclosed in the present specification may be used to clean or treat a fabric, such as those described herein. Typically at least a portion of the fabric is contacted with an embodiment of the aforementioned fabric care compositions, in neat form or diluted in a liquor, for example, a wash liquor and then the fabric may be optionally washed and/or rinsed. In one aspect, a fabric is optionally washed and/or rinsed, contacted with an embodiment of the aforementioned fabric care compositions and then optionally washed and/or rinsed. For purposes of the present disclosure, washing includes but is not limited to, scrubbing, and mechanical agitation. The fabric may comprise most any fabric capable of being laundered or treated.

The fabric care compositions disclosed in the present specification can be used to form aqueous washing solutions for use in the laundering of fabrics. Generally, an effective amount of such compositions is added to water, preferably in a conventional fabric laundering automatic washing machine, to form such aqueous laundering solutions. The aqueous washing solution so formed is then contacted, preferably under agitation, with the fabrics to be laundered therewith. An effective amount of the fabric care composition, such as the liquid detergent compositions disclosed in the present specification, may be added to water to form aqueous laundering solutions that may comprise from about 500 to about 7,000 ppm or even from about 1,000 to about 3,000 pm of fabric care composition.

In one aspect, the fabric care compositions may be employed as a laundry additive, a pre-treatment composition and/or a post-treatment composition.

While various specific embodiments have been described in detail herein, the present disclosure is intended to cover various different combinations of the disclosed embodiments and is not limited to those specific embodiments described herein. The various embodiments of the present disclosure may be better understood when read in conjunction with the following representative examples. The following representative examples are included for purposes of illustration and not limitation.

METHODS

Method for Measuring Softness

The following measurement procedures are for the Phabrometer Evaluation System FES-2, manufactured by Nu Cybertek, Inc, Davis, California. Instrument-- Phabrometer Evaluation System, FES-2 with fabric evaluation software version 1.1.3.

The circular weight that compresses the terry during phabrometer operation has a mass of 1466 grams. The weight comprises of two identical halves, each weighing 733 grams. The terry is pushed through a ring that has an inside diameter of 37.93 mm. Both the weight and the ring were purchased from Nu Cybertek.

Fabrics- The fabric used for the present method is a 13 in. x 13 in. white terry cloth, manufactured by Standard Textile. The brand name is Eurotouch and is composed of 100% cotton. The universal product number is 63491624859. The correspondence address for Standard Textile is One Knollcrest Drive, Cincinnati, Ohio 45237.

Procedure- Prior to measurement, fabrics are cut with a dye into circles that have a diameter of 11.0cm. Fabrics must equilibrate in a constant temperature (CT) room for 24 hours before measuring. The CT room temperature is 70°F with a relative humidity of 50%. Between each fabric measurement, the bottom of the weight, the inside of the ring, and the base in which the ring is sitting are cleaned with an alcohol wipe having 70% isopropyl alcohol and 30% deionized water. Alcohol wipes were purchased from VWR International. The address for VWR is 1310 Goshen Parkway, West Chester, PA 19380. The catalog number is 21910-110. The weight and ring are allowed to dry completely before the next measurement. Once used, a fabric swatch cannot be remeasured.

Data Analysis -

All raw data is exported to Microsoft Excel 2007. There are 108 data points in each exported curve, but only the first 100 are used. Each curve is integrated from 1 to 100 and the sum is reported as the unitless "Extraction Energy". For each test treatment a minimum of 6 fabric replicates are evaluated (sampling from as many different terry cloths as possible) and a sample Standard Deviation is calculated. "Extraction Energy Reduction" is obtained by subtraction of the average extraction energy of the control samples (minimum of 6) from the extraction energy average of the fabric samples treated with the above disclosed polyglycerol materials (minimum of 6 per each treatment).

Control fabrics are the above mentioned terries treated with the recommended dose of Tide Free.

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."

Every document cited herein, including any cross referenced or related patent or application, is hereby incorporated herein by reference in its entirety unless expressly excluded or otherwise limited. The citation of any document is not an admission that it is prior art with respect to any invention disclosed or claimed herein or that it alone, or in any combination with any other reference or references, teaches, suggests or discloses any such invention. Further, to the extent that any meaning or definition of a term in this document conflicts with any meaning or definition of the same term in a document incorporated by reference, the meaning or definition assigned to that term in this document shall govern.

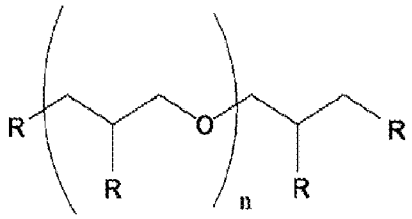
While particular aspects of the present invention have been illustrated and described, it would be obvious to those skilled in the art that various other changes and modifications can be made without departing from the spirit and scope of the invention. It is therefore intended to cover in the appended claims all such changes and modifications that are within the scope of this invention.

CLAIMS

What is claimed is:

1. A fabric and household hard surface treatment composition comprising:

a.) a mixtuer of polyglycerol esters, each having the structure of Formula I



(Formula I)

wherein each R is independently selected from the group consisting of fatty acid ester moieties comprising carbon chains having a carbon chain length of from 10 to 22 carbon atoms; -OH; and combinations thereof, preferably each R is independently selected from the group consisting of fatty acids having a carbon chain lengths of from 12 to 18 carbon atoms; -OH; and combinations thereof, more preferably the fatty acids are selected from the group consisting of saturated fatty acids; unsaturated fatty acids; and combinations thereof; wherein the mixture of polyglycerol esters has an average value of n ranging from 1.5 to 6, preferably 1.5 to 5, more preferably 1.5 to 4, has an average % esterification ranging from 15% to 100%, preferably 20% to 100%, more preferably from 20% to 90%, more preferably from 20% to 80%; has greater than or equal to 50% of the polyglycerol esters having at least two ester linkages; and has a polydispersity index of greater than 0.75; preferably said polyglycerol ester comprises less than 50% of a monoester and

b.) a treatment and/or care agent.

2. A fabric and household hard surface treatment composition according to Claim 1 wherein the carbon chains of the fatty acid moieties on the polyglycerol esters in the mixture have an average chain length of from 10 to 22 carbon atoms; and wherein the mixture of polyglycerol esters has an iodine value of from 0 to 145; an average value of n ranging from 3 to 6 and a % esterification ranging from 20% to 100%, preferably an average % esterification ranging from 25% to 90%, more preferably an average % esterification ranging from 35% to 90%.

3. A fabric and household hard surface treatment composition according to Claim 1 wherein the carbon chains of the fatty acid moieties on the polyglycerol esters in the mixture have an average carbon chain length of from 16 to 18 carbon atoms; and
wherein the mixture of polyglycerol esters has an iodine value of from 0 to 20; an average value of n ranging from 1.5 to 6, preferably an average value of n ranging from 1.5 to 4.5, more preferably an average value of n ranging from 1.5 to 3.5 and a % esterification ranging from 20% to 60%, preferably an average % esterification ranging from 20% to 70%, more preferably an average % esterification ranging from 20% to 80%.

4. A fabric and household hard surface treatment composition according to Claim 1 wherein the carbon chain or the fatty acid moieties on the polyglycerol esters in the mixture have an average carbon chain length of from 16 to 18 carbon atoms; and
wherein the mixture of polyglycerol esters has an iodine value of from 45 to 135;
   a) an average value of n ranging from 1.5 to 6 and a % esterification ranging from 25% to 60%;
   b) preferably an average value of n ranging from 1.5 to 4.5 and has an average % esterification ranging from 20% to 70%
   c) more preferably an average value of n ranging from 1.5 to 3.5 and has an average % esterification ranging from 25% to 60%.

5. A fabric and household hard surface treatment composition according to Claim 1 wherein the mixture of polyglycerol esters has an average value of is ranging from 3 to 6 and an average % esterification ranging from 25% to 90%, preferably an average % esterification ranging from 35% to 90%.

6. A fabric and household hard surface treatment composition according to Claim 1 wherein the carbon chain on the fatty acid moieties on the polyglycerol esters in the mixture have an average carbon chain length of from 12 to 18 carbon atoms, and
wherein the mixture of polyglycerol esters has an average value of n ranging from 1.5 to 6 and a % esterification ranging from 20% to 80%.

7. A fabric and household hard surface treatment composition according to Claim 1 comprising one or more cyclic polyglycerol molecules.

8. A fabric and household hard surface treatment composition according to Claim 1 comprising from 50% to 100% of an ester that is a diester or higher.

9. A fabric and household hard surface treatment composition according to any preceding claim, wherein the treatment and/or care agent comprises a material selected from the group consisting of polymers, surfactants, builders, chelating agents, dye transfer inhibiting agents, dispersants, enzymes, enzyme stabilizers, catalytic materials, bleach activators, polymeric dispersing agents, clay soil removal/anti-redeposition agents, brighteners, suds suppressors, dyes, perfume, perfume delivery systems, deposition aids, structure elasticizing agents, fabric softeners, carriers, hydrotropes, processing aids and/or pigments, and mixtures thereof, preferably the treatment and/or care agent comprises a deposition aid, a fabric softener and/or a perfume microcapsule, more preferably the fabric softener comprises an organosilicone, preferably an organosilicone selected from the group consisting of (a) non-functionalized siloxane polymers, (b) functionalized siloxane polymers, and combinations thereof and/or a quaternary ammonium compound, preferably the ratio of the polyglycerol ester to the quaternary ammonium compound ranges from 10:1 to 1:5.

10. An article comprising the fabric and household hard surface treatment composition according to any preceding claim.

11. A method of treating and/or cleaning a situs comprising the steps of a) optionally washing and/or rinsing the situs; b) contacting the situs with a composition according toany preceding claim; and c) optionally, washing and/or rinsing the situs.

12. A method of providing a freshness benefit to a textile, comprising applying the fabric and household hard surface treatment composition of any preceding claim to a textile, wherein the treatment and/or care agent comprises a perfume.

13. A fabric and household hard surface treatment composition according to any preceding claim, wherein the composition provides an extraction energy reduction of from 5 to 30.

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2011/024322

A. CLASSIFICATION OF SUBJECT MATTER
INV. C11D1/66 C11D3/20 C11D3/37 C11D1/835
ADD. C11D1/62

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 practical, 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,P	WO 2010/019727 A1 (PROCTER & GAMBLE [US]; PONDER JENNIFER BETH [US]; BAKER KEITH HOMER [U) 18 February 2010 (2010-02-18)	1-13
L	the whole document	1-13

X	WO 2009/146071 A2 (PROCTER & GAMBLE [US]; OLIVER RICHARD EUGENE [US]; FAHLBUSCH RAMONA QU) 3 December 2009 (2009-12-03) claims 1-7	1-9,11, 13

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

☒ See patent family annex.

* Special categories of cited documents :

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
13 May 2011	27/05/2011

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/US2011/024322

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