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(54) **Title**: LAUNDRY COMPOSITIONS

(57) **Abstract**: The invention is directed to laundry compositions containing (a) surfactant, (b) a cationic polysaccharide polymer, and (c) a fabric softening silicone, wherein the weight ratio of silicone to cationic polysaccharide polymer is from 4.5:1 to 1.5:1.

LAUNDRY COMPOSITIONS

FIELD OF THE INVENTION

This invention relates to a laundry composition. More particularly, the invention is directed to a softening in the wash laundry composition.

BACKGROUND OF THE INVENTION

Textile fabrics, including clothes, have traditionally been cleaned with laundry detergents. After cleaning, fabrics can often feel harsh. To prevent this, especially harshness experienced after multiple wash cycles, technologies have been developed to increase the softness of fabrics, including rinse-added conditioner compositions and softening systems added to the detergent composition.

Fabric softening cationic polymers, and fabric softening silicones have been used to provide softness to fabrics from a laundry detergent composition.

WO 2005/087907 discloses liquid detergent compositions comprising surfactants, polydimethylsiloxane (a softening silicone) and polyquaternium 7 (a polymeric quaternary salt consisting of acrylamide and dimethyl diallyl ammonium chloride monomers).

However there is a need to improve the softness benefit provided. There is further a need to provide softening detergent compositions that provide improved cleaning.

SUMMARY OF THE INVENTION

In a first aspect, the invention is directed to a laundry detergent composition comprising:-

(a) from 1 to 80 wt.% of surfactant;

(b) from 0.1 to 10 wt.% of fabric softening silicone; and,

(c) from 0.05 to 2.5 wt.% of cationic polysaccharide polymer,

wherein the weight ratio of the silicone to cationic polysaccharide polymer is from 4.5:1 to 1.5:1.

Preferably the detergent composition is a liquid detergent composition.

Preferably the liquid detergent composition has a pH of from 6 to 10, more preferably from pH 6.5 to 9, for example from pH 6.5 to 8.5.

A preferred level of the cationic polymer is from 0.1 to 2 wt.%, more preferably from 0.1 to 1 wt.%.

Preferred cationic polysaccharide polymers are cationic guar and cationic cellulose polymers. Particularly preferred is hydroxy ether cellulose that is modified by incorporation of cationic groups (i.e. quaternised hydroxy ethyl cellulose).

Preferably the silicone is in the form of an emulsion.

Preferably the silicone is a polydimethylsiloxane.

Preferably the silicone is an aminosilicone.

Preferably the silicone is an anionic silicone.

Preferably the weight ratio of the silicone to the cationic polymer is from 4:1 to 2:1.

Optionally, but preferably, the composition further comprises an ingredient selected from, shading dye, enzyme, an antiredeposition polymer, a dye transfer inhibiting polymer, builder, sequestrant, sunscreen and/or soil release polymer.

In a second aspect, the invention provides the use of a composition according to the first aspect of the invention to soften fabrics.

DETAILED DESCRIPTION OF THE INVENTION

As used herein, the term "comprising" means including, made up of, composed of, consisting and/or consisting essentially of.

All percentages quoted are wt.% based on total amount in the laundry composition unless otherwise stated.

The invention is directed to laundry compositions containing surfactant, a cationic polymer, and a fabric softening silicone, wherein the weight ratio of silicone to cationic polymer is from 4.5:1 to 1.5:1. The composition displays improved fabric softening.

Form of the Invention

The invention can take any of a number of forms that are laundry compositions. Examples include powders, granules, bars, gels and liquids. Preferably the composition is in the form of a liquid laundry product. Preferably they are main wash products. It can take the form of a laundry composition for the main wash, which may be dilutable or non-dilutable. The laundry composition may for example be an isotropic liquid, or a surfactant-structured liquid. Particularly preferred forms of this invention include combination detergent/softener products to provide "softening in the wash".

Preferably the detergent composition has a pH of from 6 to 10, more preferably from pH 6.5 to 9, for example from pH 6.5 to 8.5.

Surfactants

The detergent composition comprises surfactant.

Preferably the surfactant comprises nonionic surfactant, and anionic surfactant.

The nonionic surfactant if present, preferably comprises alcohol ethoxylate.

The alcohol ethoxylates are formed from the reaction of primary or secondary alcohols with ethylene oxide. Typicially an aliphatic C_8 to C_{18} primary or secondary linear or branched alcohol is reacted with ethylene oxide in the required molar amount to produce the alcohol ethoxylate. Preferred alcohol ethoxylates have from 2 to 40, preferably from 3 to 30, more preferably from 5 to 20 ethylene oxide units attached to the aliphatic chain.

The surfactants may be chosen from the surfactants described in "Surface Active Agents" Vol. 1, by Schwartz & Perry, Interscience 1949, Vol. 2 by Schwartz, Perry & Berch, Interscience 1958, in the current edition of "McCutcheon's Emulsifiers and Detergents" published by Manufacturing Confectioners Company or in "Tenside-Taschenbuch", H. Stache, 2nd Edn., Carl Hauser Verlag, 1981. Preferably the surfactants used are saturated.

Suitable nonionic detergent compounds which may be used include, in particular, the reaction products of compounds having a hydrophobic group and a reactive hydrogen atom, for example, aliphatic alcohols, acids, amides or alkyl phenols with alkylene oxides, especially ethylene oxide either alone or with propylene oxide. Specific nonionic detergent compounds are C_6 to C_{22} alkyl phenol-ethylene oxide condensates, generally 5 to 25 EO, i.e. 5 to 25 units of ethylene oxide per molecule, and the condensation products of aliphatic C_8 to C_{18} primary or secondary linear or branched alcohols with ethylene oxide, generally 5 to 40 EO.

Suitable anionic detergent compounds which may be used can be water-soluble alkali metal salts of organic sulphates and sulphonates having alkyl radicals con-

taining from about 8 to about 22 carbon atoms, the term alkyl being used to include the alkyl portion of higher acyl radicals. Examples of suitable synthetic anionic detergent compounds are sodium and potassium alkyl sulphates, especially those obtained by sulphating higher C_8 to C_{18} alcohols, produced for example from tallow or coconut oil, sodium and potassium alkyl C_9 to C_{20} benzene sulphonates, particularly sodium linear secondary alkyl C_{10} to C_{15} benzene sulphonates; and sodium alkyl glyceryl ether sulphates, especially those ethers of the higher alcohols derived from tallow or coconut oil and synthetic alcohols derived from petroleum. The anionic surfactant may also include soaps of C_6-C_{22} fatty acids. The preferred anionic detergent compounds are sodium C_{11} to C_{15} alkyl benzene sulphonates and sodium C_{12} to C_{18} alkyl sulphates. Salts of sulphonates included as hydrotrobes can additionally be considered as anionic surfactants as defined herein. Also applicable are surfactants such as those described in EP-A-328 177 (Unilever), which show resistance to salting-out, the alkyl polyglycoside surfactants described in EP-A-070 074, and alkyl monoglycosides.

The total amount of surfactant present in the composition is from 1 to 80 wt.%. The surfactant level is preferably at least 6 wt.%, more preferably at least 10 wt.%, More preferably the total amount of surfactant is from 15 to 65 wt.%, preferably from 10 to 50 wt.%.

The nonionic detergent is preferably present in amounts of from 2 to 40 wt.%, preferably from 5 to 35 wt.%, more preferably from 6 to 20 wt.%.

The anionic surfactant is preferably present in amounts of from 4 to 40 wt.%, preferably from 5 to 35 wt.%, more preferably from 6 to 20 wt.%.
Other surfactants such as amphoteric, zwitterionic and cationic surfactants may also be present in addition to the aforementioned nonionic and anionic surfactants.

Fabric Softening Silicone

The composition comprises fabric softening silicone at a level of from 0.1 to 10 wt.%, preferably from 0.2 to 5 wt.%, more preferably from 0.5 to 3 wt.%.

The fabric softening silicone may be but are not limited to 1) non-functionalized silicones such as polydimethylsiloxane (PDMS) or alkyl (or alkoxy) functional silicones 2) functionalized silicones or copolymers with one or more different types of functional groups such as amino, phenyl, polyether, acrylate, siliconhydride, carboxylic acid, quaternized nitrogen, etc. When the silicone is in the form of a silicone emulsion, then preferably the particle size is in the range from about 1 nm to 100 microns and preferably from about 10 nm to about 10 microns including microemulsions (< 150 nm), standard emulsions (about 200 nm to about 500 nm) and macroemulsions (about 1 micron to about 20 microns).

Preferred silicones are selected from polydialkylsiloxanes, especially polydimethylsiloxane; amino functionalised silicones; and anionic silicones, especially carboxyl functionalised silicone

Preferably the fabric softening silicone is a polydimethylsiloxane.

Cationic Polymer

The composition comprises a cationic polysaccharide polymer at a level of from 0.05 to 2.5 wt.%, preferably from 0.1 to 2 wt.%, more preferably from 0.2 to 1 wt.%.

This term refers to polymers having an overall positive charge.

More preferably the cationic polysaccharide polymer is a cationic guar or cationic cellulose polymer. Most preferably the cationic polymer is a cationic cellulose polymer, for example, quaternised hydroxy ethyl cellulose.

Cationic Polysaccharide Polymer

The term “cationic polysaccharide polymer” refers to polymers having a polysaccharide backbone and an overall positive charge. Polysaccharides are polymers made up from monosaccharide monomers joined together by glycosidic bonds.

The cationic polysaccharide-based polymers present in the compositions of the invention have a modified polysaccharide backbone, modified in that additional chemical groups have been reacted with some of the free hydroxyl groups of the polysaccharide backbone to give an overall positive charge to the modified cellulosic monomer unit.

A preferred class of cationic polysaccharide polymers suitable for this invention are those that have a polysaccharide backbone modified to incorporate a quaternary ammonium salt. Preferably the quaternary ammonium salt is linked to the polysaccharide backbone by a hydroxyethyl or hydroxypropyl group. Preferably the charged nitrogen of the quaternary ammonium salt has one or more alkyl group substituents.

Preferred cationic polysaccharide-based polymers have a guar based, or cellulosic based backbone. Cellulose based cationic polymers are most preferred. Guar is a galactomannan having a β-1,4 linked mannose backbone with branchpoints to α-1,6 linked galactose units.

Suitable cationic guar gum derivatives, such as guar hydroxypropyltrimonium chloride, specific examples of which include the Jaguar series commercially available from Rhone-Poulenc Incorporated and the N-Hance series commercially available from Aqualon Division of Hercules, Inc.

An example of a preferred guar based cationic polymer is guar 2-hydroxy-3-(trimethylammonium) propyl ether salt.

Cellulose is a polysaccharide with glucose as its monomer, specifically it is a straight chain polymer of D-glucopyranose units linked via β-1,4 glycosidic bonds and is a linear, non-branched polymer.

Example cationic cellulose polymers are salts of hydroxyethyl cellulose reacted with trimethyl ammonium substituted epoxide, referred to in the field under the International Nomenclature for Cosmetic Ingredients as Polyquatemium 10 and is commercially available from the Amerchol Corporation, a subsidiary of The Dow Chemical Company, marketed as the Polymer LR, JR, and KG series of polymers. Other suitable types of cationic celluloses include the polymeric quaternary ammonium salts of hydroxyethyl cellulose reacted with lauryl dimethyl ammonium-substituted epoxide referred to in the field under the International Nomenclature for Cosmetic Ingredients as Polyquatemium 24. These materials are available from Amerchol Corporation marketed as Polymer LM-200.

Typical examples of preferred cationic cellulosic polymers include cocodimethylammonium hydroxypropyl oxyethyl cellulose, lauryldimethylammonium hydroxypropyl oxyethyl cellulose, stearyldimethylammonium hydroxypropyl oxyethyl cellulose, and stearyldimethylammonium hydroxyethyl cellulose; cellulose 2-hydroxyethyl 2-hydroxy 3-(trimethyl ammonio) propyl ether salt, polyquaternium-4, polyquaternium-10, polyquaternium-24 and polyquaternium-67 or mixtures thereof.

More preferably the cationic cellulosic polymer is a quaternised hydroxy ether cellulose cationic polymer. These are commonly known as polyquaternium-10. Suitable commercial cationic cellulosic polymer products for use according to the present invention are marketed by the Amerchol Corporation under the trade name UCARE.

The counterion of the cationic polymer is freely chosen from the halides: chloride, bromide, and iodide; or from hydroxide, phosphate, sulphate, hydrosulphate, ethyl sulphate, methyl sulphate, formate, and acetate.

Many of the aforementioned cationic polymers can be synthesised in, and are commercially available in, a number of different molecular weights. Preferably the molecular weight of the cationic polymer is from 10,000 to 2,000,000 Daltons, more preferably from 10,000 to 1,000,000 Daltons, even more preferably from 100,000 to 1,000,000 Daltons.

Optional Ingredients

The detergent composition may optionally comprise one or more of the following optional ingredients, shading dye, enzyme, antiredeposition polymer, dye transfer inhibiting polymer, builder, sequestrant, sunscreen and/or soil release polymer.

Builders and sequestrants

The detergent compositions may also optionally contain relatively low levels of organic detergent builder or sequestrant material. Examples include the alkali metal, citrates, succinates, malonates, carboxymethyl succinates, carboxylates, polycarboxylates and polyacetyl carboxylates. Specific examples include sodium, potassium and lithium salts of oxydisuccinic acid, mellitic acid, benzene polycarboxylic acids, ethylene diamine tetra-acetic acid, diethylenetriamine-pentaacetic acid, alkyl- or alkenylsuccinic acid, nitrilotriacetic acid, and citric acid. Other examples are DEQUEST™, organic phosphonate type sequestering agents sold by Thermophos and alkanehydroxy phosphonates.

Other suitable organic builders include the higher molecular weight polymers and copolymers known to have builder properties. For example, such materials include appropriate polyacrylic acid, polymaleic acid, and polyacrylic/polymaleic acid copolymers and their salts, such as those sold by BASF under the name SOKALAN™. Another suitable builder is sodium carbonate.

If utilized, the builder materials may comprise from about 0.5% to 20 wt%, preferably from 1 wt% to 10 wt%, of the composition. The preferred builder level is less than 10 wt% and preferably less than 5 wt% of the composition.

Preferably the laundry detergent formulation is a non-phosphate built laundry detergent formulation, i.e., contains less than 1 wt.% of phosphate.

Shading Dye

Shading dyes deposit to fabric during the wash or rinse step of the washing process providing a visible hue to the fabric. Shading of white garments may be done with any colour depending on consumer preference. Blue and Violet are particularly preferred shades and consequently preferred dyes or mixtures of dyes are ones that give a blue or violet shade on white fabrics. The shading dyes used are preferably blue or violet.

The shading dye chromophore is preferably selected from the group comprising: mono-azo, bis-azo, triphenylmethane, triphenodioxazine, phthalocyanin, naptholactam, azine and anthraquinone. Most preferably mono-azo, bis-azo, azine and anthraquinone.

Most preferably the dye bears at least one sulfonate group.

Preferred shading dyes are selected from direct dyes, acid dyes, hydrophobic dyes, cationic dyes and reactive dyes.

If included, the shading dye is present is present in the composition in range from 0.0001 to 0.01 wt %.

Fluorescent Agent

The composition preferably comprises a fluorescent agent (optical brightener). Fluorescent agents are well known and many such fluorescent agents are available commercially. Usually, these fluorescent agents are supplied and used in the form of their alkali metal salts, for example, the sodium salts. The total amount of the fluorescent agent or agents used in the composition is generally from 0.005 to 2 wt.%, more preferably 0.01 to 0.1 wt.%. Preferred classes of fluorescer are: Di-styryl biphenyl compounds, e.g. Tinopal (Trade Mark) CBS-X, Di-amine stilbene di-sulphonic acid compounds, e.g. Tinopal DMS pure Xtra and Blankophor (Trade Mark) HRH, and Pyrazoline compounds, e.g. Blankophor SN. Preferred fluorescers are: sodium 2-(4-styryl-3-sulfophenyl)-2H-napthol[1,2-d]trazole, disodium 4,4'-bis{[(4-anilino-6-(N methyl-N-2 hydroxyethyl) amino 1,3,5-triazin-2-yl)]amino}stilbene-2-2' disulfonate, disodium 4,4'-bis{[(4-anilino-6-morpholino-1,3,5-triazin-2-yl)]amino} stilbene-2-2' disulfonate, and disodium 4,4'-bis(2-sulfoslyryl)biphenyl.

Perfume

Preferably the composition comprises a perfume. The perfume is preferably in the range from 0.001 to 3 wt.%, most preferably 0.1 to 1 wt.%. Many suitable examples of perfumes are provided in the CTFA (Cosmetic, Toiletry and Fragrance Association) 1992 International Buyers Guide, published by CFTA Publications and OPD 1993 Chemicals Buyers Directory 80th Annual Edition, published by Schnell Publishing Co.

It is commonplace for a plurality of perfume components to be present in a formulation. In the compositions of the present invention it is envisaged that there will be four or more, preferably five or more, more preferably six or more or even seven or more different perfume components.

In perfume mixtures preferably 15 to 25 wt.% are top notes. Top notes are defined by Poucher (Journal of the Society of Cosmetic Chemists 6(2):80 [1955]).

Preferred top-notes are selected from citrus oils, linalool, linalyl acetate, lavender, dihydromyrcenol, rose oxide and cis-3-hexanol.

It is preferred that the laundry treatment composition does not contain a peroxygen bleach, e.g., sodium percarbonate, sodium perborate, and peracid.

Polymers

The composition may comprise one or more polymers. Polymers can assist in the cleaning process by helping to retail soil in solution or suspension and/or preventing the transfer of dyes. Polymers can also assist in the soil removal process. Dye transfer, anti-redeposition and soil-release polymers are described in further detail below.

The composition may comprise one or more polymers. Examples are carboxymethylcellulose, hydroxyethyl cellulose, hydroxpropyl cellulose, poly(ethylene glycol), poly(vinyl alcohol), ethoxylated polyamines, polycarboxylates such as polyacrylates, maleic/acrylic acid copolymers and lauryl methacrylate/acrylic acid copolymers.

Dye transfer inhibitors

Modern detergent compositions typically employ polymers as so-called 'dye-transfer inhibitors'. These prevent migration of dyes, especially during long soak times. Generally, such dye-transfer inhibiting agents include polyvinyl pyrrolidone polymers, polyamine N-oxide polymers, copolymers of N-vinylpyrrolidone and N-vinylimidazole, manganese pthalocyanine, peroxidases, and mixtures thereof, and are usually present at a level of from 0.01 to 10 wt.% based on total amount in the laundry composition.

Anti-redeposition polymers

Anti-redeposition polymers are designed to suspend or disperse soil. Typically antiredeposition polymers are ethoxylated and or propoxylated polyethylene imine

or polycarboxylate materials, for example, Acrylic acid based homo or copolymers available under the trade mark ACUSOL from Dow Chemical, Alcosperse from Akzonobel or Sokolan from BASF.

Soil Release Polymers

Examples of suitable soil release polymers include graft copolymers of poly(vinyl ester), e.g., C_1 -C_6 vinyl esters, preferably poly(vinyl acetate) grafted onto polyalkylene oxide backbones. Commercially available soil release agents of this kind include the SOKALAN type of material, e.g., SOKALAN HP-22, available from BASF (Germany). Further suitable soil release polymers of a different type include the commercially available material ZELCON 5126 (from DuPont) and MILEASE T (from ICI). If present, the soil release polymer may be included at a level of from from 0.01 to 10 wt.% based on total amount in the laundry composition. Further examples of soil release polymers are terephthalic acid / glycol copolymers sold under the tradenames Texcare, Repel-o-tex, Gerol, Marloquest, Cirrasol.

Hydrotrope

If in the form of a liquid, then the liquid detergent composition may optionally include a hydrotrope, which can prevent liquid crystal formation. The addition of the hydrotrope thus aids the clarity/transparency of the composition. Suitable hydrotropes include but are not limited to propylene glycol, ethanol, glycerol, urea, salts of benzene sulphonate, toluene sulphonate, xylene sulphonate or cumene sulphonate. Suitable salts include but are not limited to sodium, potassium, ammonium, monoethanolamine, triethanolamine. Salts of sulphonates can also be considered as anionic surfactants as defined herein. Preferably, the hydrotrope is selected from the group consisting of propylene glycol, xylene sulfonate, ethanol, and urea to provide optimum performance. The amount of the hydrotrope is generally in the range of from 0 to 30%, preferably from 0.5 to 30%, more preferably from 0.5 to 30%, most preferably from 1 to 15%.

Enzymes

Enzymes can also be present in the formulation. Preferred enzymes include protease, lipase, pectate lyase, amylase, cutinase, cellulase, mannanase. If present the enzymes may be stabilized with a known enzyme stabilizer for example boric acid.

Examples

Two control formulations 'A' and 'B' that did not include the cationic polymer or a silicone were tested against formulations 'C', 'D', 'E' and formulations 1 and 2, all with and without silicone (e.g. 1 & 1(Sil)). The formulations are listed in tables 1 and 2.

Method of Production of formulation

Water and hydrotropes are mixed together at ambient temperature (approximately 22°C) for 2-3 minutes at a shear rate of 150 rpm using a Janke & Kunkel IKA RW20 overhead mixer. Salts and alkalis are added and mixed for 5 minutes prior to addition of surfactants and fatty acid. The mixture will exhibit a slight exotherm at this point. After allowing to cool to <30°C, the LR400 solution, and any remaining components such as perfume, preservatives, and dyes are added.

Softness experiment

12 pieces of 20cm x 20cm terry towel along with 1.8kg of polycotton ballast fabric was added to a front loading automatic washing machine. 75ml of formulation was dosed into a dosing ball, followed by the required amount of silicone emulsion. The mixture was stirred for 2 minutes. The dosing ball containing the formulation and silicone was then added to the drum of the washing machine. The fabrics were then washed using the cotton short cycle at 40°C of a Miele automatic washing machine. After the cycle the fabrics were line dried. This process was repeated 5 times.

Table 1

Ingredient	A %.wt	B %.wt	C %.wt	C(Sil) %.wt	D %.wt	D(Sil) %.wt
Glycerol	1.0	1.0	1.0	1.0	1.0	1.0
TEA	1.8	1.8	1.8	1.8	1.8	1.8
Citric acid	0.9	0.9	0.9	0.9	0.9	0.9
Neodol 25-7	10.0	10.0	10.0	10.0	10.0	10.0
LAS acid	7.0	7.0	7.0	7.0	7.0	7.0
Fatty acid	1.0	1.0	1.0	1.0	1.0	1.0
SLES	3.0	3.0	3.0	3.0	3.0	3.0
Phosphonate	0.23	0.23	0.23	0.23	0.23	0.23
Active Silicone[1]	-	-	-	0.53	-	0.53
LR400[2]	-	-	0.07	0.07	0.53	0.53
Ratio of Silicone to Cationic Polymer	-	-	-	8:1	-	1:1
NaOH	to pH 8.5	to pH 8.5	to pH 8.5	to pH 8.5	to pH 8.5	to pH 8.5
Water	to 100	to 100	to 100	to 100	to 100	to 100

[1] Silicone was a carboxylic functional silicone supplied by Wacker Chemie, added as an emulsion.

[2] LR400 is a cationic hydroxyether cellulose polymer (known as polyquaternium 10) available from Dow Chemical

Table 2

Ingredient	E %.wt	E(Sil) %.wt	1 %.wt	1(Sil) %.wt	2 %.wt	2(Sil) %.wt
Glycerol	1.0	1.0	1.0	1.0	1.0	1.0
TEA	1.8	1.8	1.8	1.8	1.8	1.8
Citric acid	0.9	0.9	0.9	0.9	0.9	0.9
Neodol 25-7	10.0	10.0	10.0	10.0	10.0	10.0
LAS acid	7.0	7.0	7.0	7.0	7.0	7.0
Fatty acid	1.0	1.0	1.0	1.0	1.0	1.0
SLES	3.0	3.0	3.0	3.0	3.0	3.0
Phosphonate	0.23	0.23	0.23	0.23	0.23	0.23
Silicone[1]	-	0.53	-	0.53	-	0.53
LR400[2]	1.07	1.07	0.13	0.13	0.27	0.27
Ratio of Silicone to Cationic Polymer	-	1:2	-	4:1	-	2:1
NaOH	to pH 8.5	to pH 8.5	to pH 8.5	to pH 8.5	to pH 8.5	to pH 8.5
Water	to 100	to 100	to 100	to 100	to 100	to 100

[1] Silicone was a carboxylic functional silicone supplied by Wacker Chemie

[2] LR400 is a cationic hydroxyether cellulose polymer (known as polyquaternium 10) available from Dow Chemical

The formulations were tested for softness, with the results shown in table 3.

The softness was measured using a Stable Micro Systems Texture Analyser (TA) XT plus with the optional friction module attached. The TA is a commercial instrument incorporating a drive mechanism and a 5 kg load cell. The treated fabric was laid on the horizontal test platform of the instrument and a neoprene rubber cylindrical probe which is attached to the load cell was placed on the fabric surface. The texture analyser is programmed to move the probe over a distance of 40 mm forwards and backwards over the fabric at a speed of 10 mm/s. As the

probe moves the software records the frictional force experienced by the probe. The average friction coefficient over the whole test is used as a measure of softness.

For formulations C, D, E, 1 and 2, the formulation without silicone (but with cationic polymer), i.e. 'C' was measured against the formulation including silicone, i.e. C(Sil) in pairs. The results for each pair were assessed to see if there was a statistically significant (at 95% confidence level) improvement for the silicone & cationic polymer formulation.

Table 3

Formulation	Silicone to Polymer Ratio	Mean Softness Score	95% confidence	Statistical significance?
A (Control)	-	1.097	0.018	-
B (Control)	-	1.087	0.014	-
C	-	1.044	0.015	No
C(Sil)	8:1	1.080	0.017	
D	-	0.897	0.016	No
D(Sil)	1:1	0.866	0.019	
E	-	0.919	0.011	No
E(Sil)	1:2	0.914	0.021	
1	-	1.012	0.020	Yes
1(Sil)	4:1	0.967	0.017	
2	-	0.971	0.018	Yes
2(Sil)	2:1	0.896	0.017	

As can be seen from the results in table 3, only when the ratio of silicone to cationic polymer is from 4.5:1 to 1.5:1 does the inclusion of a fabric softening silicone provide a statistical significant benefit over just inclusion of the cationic polymer alone.

Example 2

Further softness experiments were as performed to establish whether the effect of silicone to cationic polymer ratio is consistent across other functional silicones. In this case a PDMS and an amino silicone were used, and the results are shown in tables 4 & 5.

Table 4

Ingredient	**F** **%.wt**	**G** **%.wt**	**H** **%.wt**	**3** **%.wt**	**J** **%.wt**	**4** **%.wt**
MPG	16.84	16.84	16.84	16.84	16.84	16.84
TEA	4.49	4.49	4.49	4.49	4.49	4.49
Neodol 25-7	16.84	16.84	16.84	16.84	16.84	16.84
LAS acid	11.57	11.57	11.57	11.57	11.57	11.57
Fatty acid	2.25	2.25	2.25	2.25	2.25	2.25
SLES	7.97	7.97	7.97	7.97	7.97	7.97
Silicone[1]			1.2	1.2	-	-
Silicone[2]	-	-	-	-	1.2	1.2
LR400[3]	-	0.16	0.04	0.16	0.04	0.16
Ratio of Silicone to Cationic Polymer	-	-	10:1	2.5:1	10:1	2.5:1
NaOH	to pH 8.5	to pH 8.5	to pH 8.5	to pH 8.5	to pH 8.5	to pH 8.5
Water	to 100	to 100	to 100	to 100	to 100	to 100

[1] Silicone 1 was PDMS 60,000 cSt supplied by Dow Corning as an emulsion

[2] Silicone 2 was amino silicone Arristan 64 supplied by CHT Beitlich as an emulsion

[3] LR400 is a cationic hydroxyether cellulose polymer (known as polyquaternium 10) available from Dow Chemical

Table 5

Formulation	Silicone to Polymer Ratio	Mean Softness Score	95% confidence	Statistical significance?
F (Control)	-	1.122	0.009	-
G (Control)	-	1.109	0.010	-
H	10:1	1.084	0.017	No
3	2.5:1	1.027	0.007	Yes
J	10:1	1.111	0.008	No
4	2.5:1	1.027	0.010	Yes

The results in table 5 show that a statistically significant softening benefit (in comparison to the controls) can be achieved only when the ratio of silicone to cationic polymer is from 4.5:1 to 1.5:1.

Example 3

Cleaning experiments were carried out that showed that when the ratio of silicone to cationic polymer is from 4.5:1 to 1.5:1 the cleaning is improved compared to a ratio of silicone to cationic polymer lower than 1.5:1 (i.e. 1:1 and 1:2).

Example 4

Comparative Example of a cationic polysaccharide polymer versus polyquaternium 7 from WO 2005/087907

Silicone deposition of both cationic polymers was tested using identical formulations varying only by the cationic polymer used. The formulations were dosed to provide silicone at 0.5g/wash and cationic polymer at 0.2g/wash.

The variables tested were:-

Control - formulation including 0.5g/wash silicone

Polysaccharide - formulation including 0.5g/wash silicone + 0.2g/wash cationic polysaccharide polymer (LR400)

Polyquat 7 - formulation including 0.5g/wash silicone + 0.2g/wash cationic polymer (polyquaternium 7)

The washes were carried out on 2 different substrates, terry towelling; and repeated on white knitted cotton. The articles were washed 6 times, dried and then friction measured after each wash. The friction measurement results in a average friction coefficient. The friction test shows how soft the articles washed were, in that the amount of silicone deposited builds-up onto the article and decreases friction.

Friction test details

The coefficient of friction was measured using a commercially available Stable Micro Systems Texture Analyser. The fabric article is placed onto a platform and a rubber probe placed on the fabric and moved at 10mm/s. The probe is moved 40mm forwards, followed by 40mm backwards. The instrument records the frictional force which is then converted into an average friction coefficient throughout the movement in both directions. The data points in the following tables show that the polysaccharide provides statistically significant improvement in reduced friction (hence increased silicone deposition) at 95% confidence levels.

Table 6 - Silicone build-up on terry towelling

Wash No.	Control	Polyquat 7 (comparative)	Polysaccharide
0	1.465 (± 0.010)	-	-
1	1.425 (± 0.017)	1.328 (± 0.011)	1.432 (± 0.013)
2	1.502 (± 0.010)	1.319 (± 0.010)	1.142 (± 0.011)
3	1.390 (± 0.030)	1.317 (± 0.013)	1.072 (± 0.014)
4	1.424 (± 0.028)	1.293 (± 0.010)	1.050 (± 0.014)
5	1.469 (± 0.012)	1.344 (± 0.010)	1.035 (± 0.020)
6	1.407 (± 0.013)	1.280 (± 0.014)	1.027 (± 0.010)

Table 7 - Silicone build-up on white knitted cotton

Wash No.	Control	Polyquat 7 (comparative)	Polysaccharide
0	1.346 (± 0.023)	-	-
1	1.421 (± 0.020)	1.369 (± 0.011)	1.462 (± 0.009)
2	1.496 (± 0.027)	1.556 (± 0.033)	1.330 (± 0.017)
3	1.416 (± 0.019)	1.373 (± 0.016)	1.218 (± 0.016)
4	1.4373 (± 0.038)	1.421 (± 0.019)	1.150 (± 0.012)
5	1.289 (± 0.008)	1.333 (± 0.018)	1.119 (± 0.010)
6	1.396 (± 0.019)	1.324 (± 0.011)	1.139 (± 0.011)

Thus it can be seen from the results in tables 6 & 7 that the cationic polysaccharide polymer provides superior deposition of silicone over that prior art polyquaternium-7 disclosed in WO 2005/087907.

CLAIMS

1. A laundry detergent composition comprising:-
   (a) from 1 to 80 wt.% of surfactant;
   (b) from 0.1 to 10 wt.% of fabric softening silicone; and
   (c) from 0.05 to 2.5 wt.% of cationic polysaccharide polymer,
   wherein the weight ratio of silicone to cationic polysaccharide polymer is from 4.5:1 to 1.5:1.

2. A composition according to claim 1, which is a liquid detergent composition.

3. A composition according to claim 2, wherein liquid composition has a pH of from 6 to 10, preferably from pH 6.5 to 9, most preferably from pH 6.5 to 8.

4. A composition according to any preceding claim, wherein the cationic polysaccharide polymer is present at a level of from 0.1 to 2 wt.%, preferably from 0.1 to 1 wt.%.

5. A composition according to any preceding claim, wherein the cationic polysaccharide polymer comprises cationic guar and/or cationic cellulose polymers.

6. A composition according to claim 5, wherein the cationic polysaccharide polymer is a cationic cellulose polymer, preferably quaternised hydroxy ethyl cellulose.

7. A composition according to any preceding claim, wherein the silicone is in the form of an emulsion.

8. A composition according to any preceding claim, wherein the silicone is polydimethylsiloxane.

9. A composition according to any preceding claim, wherein the silicone is an amino silicone.

10. A composition according to any preceding claim, wherein the silicone is an anionic functionalised silicone, preferably a carboxyl functionalised silicone.

11. A composition according to any preceding claim, wherein the composition further comprises an ingredient selected from, shading dye, enzyme, an antiredeposition polymer, a dye transfer inhibiting polymer, builder, sequestrant, sunscreen and/or soil release polymer.

12. Use of a composition according to any one of claims 1 to 11 to soften fabrics.

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2013/070526

A. CLASSIFICATION OF SUBJECT MATTER
INV. C11D1/00 C11D3/00 C11D3/37
ADD.

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

B. FIELDS SEARCHED

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

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

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
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C. DOCUMENTS CONSIDERED TO BE RELEVANT

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Y	WO 2008/120176 A1 (PROCTER & GAMBLE [US]; WAHL ERROL HOFFMAN [US]; FRANKENBACH GAYLE MARI) 9 October 2008 (2008-10-09) example II	1-12
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A	WO 00/59463 A1 (UNILEVER PLC [GB]; UNILEVER NV [NL]; LEVER HINDUSTAN LTD [IN]) 12 October 2000 (2000-10-12) examples 10,11	1-12

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[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"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
4 December 2013	11/12/2013

Name and mailing address of the ISA/	Authorized officer
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INTERNATIONAL SEARCH REPORT

International application No
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C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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