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(54) Title: LAUNDRY COMPOSITION

(57) Abstract: A laundry composition comprising: a. Cationic polymer b. Anionic silicone emulsion c. Dye comprising 1 to 4 anionic groups; and d. 3 to 60 % surfactant by weight of the composition wherein the cationic polymer and anionic silicone form a soluble complex wherein the cationic polymer has a molecular weight of 20 000 to 2 000 000 g/mol A method of improving the delivery of silicone to a fabric surface, wherein a fabric is treated with said composition. A use of said composition for improving softening of fabrics.



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## LAUNDRY COMPOSITION

### Field of the invention

5 The present invention relates to a laundry composition providing improved softening to fabrics. In particular laundry compositions providing improved deposition of silicones to fabrics.

### Background of the invention

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Textile fabrics, including clothes can often feel harsh after the laundry process. To reduce the harshness experienced after multiple wash cycles, consumers seek care benefits from their laundry products. In particular softening is desired by the consumers.

15

EP1567627 discloses a liquid fabric treatment composition comprising at least one cationic polymer and at least one anionic polymer, wherein at least one of these two polymers is a silicone polymer, and wherein the composition forms a coacervate phase.

20

Coacervation, associative phase separation and understanding of polymer/surfactant behaviour and particular the effects which drive the formation of complex coacervates is a well-documented field. For example 'Association and segregation in aqueous polymer/polymer, polymer/surfactant, and surfactant/surfactant mixtures: similarities and differences' Lennart Piculell and Björn Lindman, *Advances in Colloid and Interface Science*, 41 (1992) 149-178.

25

Formation of coacervates, large phase separated material does not necessarily result in ideal deposition in the context of the laundry process. For front loading automatic machines coacervation is unlikely to be compatible with dosing from the drawer; alternatively, drum dosing in a front loading machine or top loading machine may not

30 promote even distribution of material through the wash load. This would result in poor deposition and therefore poor softening.

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There is a need to improve the softening performance provided by the fabric treatment compositions. The compositions of the present invention provide a soluble complex, which delivers superior softening.

5 Summary of the invention

In a first aspect of the present invention, there is provided a laundry composition comprising:

- 10 a. Cationic polymer
- b. Anionic silicone emulsion
- c. Dye comprising 1 to 4 anionic groups; and
- d. 3 to 60 % surfactant by weight of the composition

wherein the cationic polymer, anionic silicone and dye form a soluble complex.

15

In a second aspect of the present invention, there is provided a method of improving the delivery of silicone to a fabric surface, wherein a fabric is treated with a composition according to the present invention.

- 20 In a third aspect of the present invention, there is provided a use of a composition according to the present invention for improving softening of fabrics.

Detailed description of the invention

- 25 These and other aspects, features and advantages will become apparent to those of ordinary skill in the art from a reading of the following detailed description and the appended claims. For the avoidance of doubt, any feature of one aspect of the present invention may be utilised in any other aspect of the invention. The word “comprising” is intended to mean “including” but not necessarily “consisting of” or “composed of.” In
- 30 other words, the listed steps or options need not be exhaustive. It is noted that the examples given in the description below are intended to clarify the invention and are not intended to limit the invention to those examples per se. Similarly, all percentages are weight/weight percentages unless otherwise indicated. Except in the operating and comparative examples, or where otherwise explicitly indicated, all numbers in this

description indicating amounts of material or conditions of reaction, physical properties of materials and/or use are to be understood as modified by the word "about". Numerical ranges expressed in the format "from x to y" are understood to include x and y. When for a specific feature multiple preferred ranges are described in the format "from x to y", it is understood that all ranges combining the different endpoints are also contemplated.

### **Cationic polymer**

The laundry composition of the present invention comprises a cationic polymer. This refers to polymers having an overall positive charge.

The cationic polymer may be naturally derived or synthetic. Examples of suitable cationic polymers include: acrylate polymers, cationic amino resins, cationic urea resins, and cationic polysaccharides, including: cationic celluloses, cationic guar and cationic starches.

The cationic polymer of the present invention may be categorised as a polysaccharide-based cationic polymer or non-polysaccharide based cationic polymers.

Polysaccharide-based cationic polymers:

Polysaccharide based cationic polymers include cationic celluloses, cationic guar and cationic starches. 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.

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A preferred polysaccharide polymer is cationic cellulose. This refers to polymers having a cellulose backbone and an overall positive charge.

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

10 The cationic cellulose-based polymers of the present invention have a modified cellulose 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 cellulose monomer unit.

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

20 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 Polyquaternium 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  
25 cellulose reacted with lauryl dimethyl ammonium- substituted epoxide referred to in the field under the International Nomenclature for Cosmetic Ingredients as Polyquaternium 24. These materials are available from Amerchol Corporation marketed as Polymer LM-200.

30 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

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2- hydroxy 3-(trimethyl ammonio) propyl ether salt, polyquaternium-4, polyquaternium-10, polyquaternium-24 and polyquaternium-67 or mixtures thereof.

5 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.

10 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.

Non polysaccharide-based cationic polymers:

15 A non-polysaccharide-based cationic polymer is comprised of structural units, these structural units may be non-ionic, cationic, anionic or mixtures thereof. The polymer may comprise non-cationic structural units, but the polymer must have a net cationic charge.

20 The cationic polymer may consists of only one type of structural unit, i.e., the polymer is a homopolymer. The cationic polymer may consists of two types of structural units, i.e., the polymer is a copolymer. The cationic polymer may consists of three types of structural units, i.e., the polymer is a terpolymer. The cationic polymer may comprises two or more types of structural units. The structural units may be described as first structural units, second structural units, third structural units, etc. The structural units, or monomers, may  
25 be incorporated in the cationic polymer in a random format or in a block format.

The cationic polymer may comprise a nonionic structural units derived from monomers selected from: (meth)acrylamide, vinyl formamide, N, N-dialkyl acrylamide, N, N-dialkylmethacrylamide, C1-C12 alkyl acrylate, C1-C12 hydroxyalkyl acrylate, polyalkylene glycol acrylate, C1-C12 alkyl methacrylate, C1-C12 hydroxyalkyl methacrylate,  
30 polyalkylene glycol methacrylate, vinyl acetate, vinyl alcohol, vinyl formamide, vinyl acetamide, vinyl alkyl ether, vinyl pyridine, vinyl pyrrolidone, vinyl imidazole, vinyl caprolactam, and mixtures thereof.

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The cationic polymer may comprise a cationic structural units derived from monomers selected from: N, N-dialkylaminoalkyl methacrylate, N, N-dialkylaminoalkyl acrylate, N, N-dialkylaminoalkyl acrylamide, N, N-dialkylaminoalkylmethacrylamide, methacrylamidoalkyl trialkylammonium salts, acrylamidoalkyltrialkylammonium salts, vinylamine, vinylimine,  
5 vinyl imidazole, quaternized vinyl imidazole, diallyl dialkyl ammonium salts, and mixtures thereof.

Preferably, the cationic monomer is selected from: diallyl dimethyl ammonium salts (DADMAS), N, N-dimethyl aminoethyl acrylate, N,N-dimethyl aminoethyl methacrylate  
10 (DMAM), [2-(methacryloylamino)ethyl]tri-methylammonium salts, N, N-dimethylaminopropyl acrylamide (DMAPA), N, N-dimethylaminopropyl methacrylamide (DMAPMA), acrylamidopropyl trimethyl ammonium salts (APTAS), methacrylamidopropyl trimethylammonium salts (MAPTAS), quaternized vinylimidazole (QVi), and mixtures thereof.

15

The cationic polymer may comprise a anionic structural units derived from monomers selected from: acrylic acid (AA), methacrylic acid, maleic acid, vinyl sulfonic acid, styrene sulfonic acid, acrylamidopropylmethane sulfonic acid (AMPS) and their salts, and mixtures thereof.

20

Some cationic polymers disclosed herein will require stabilisers i.e. materials which will exhibit a yield stress in the ancillary laundry composition of the present invention. Such stabilisers may be selected from: thread like structuring systems for example hydrogenated castor oil or trihydroxystearin e.g. Thixcin ex. Elementis Specialties,  
25 crosslinked polyacrylic acid for example Carbopol ex. Lubrizol and gums for example carrageenan.

Preferably the cationic polymer is selected from; cationic polysaccharides and cationic acrylate polymers.

30

The molecular weight of the cationic polymer is preferably greater than 20 000 g/mol, more preferably greater than 25 000 g/mol. The molecular weight is preferably less than 2 000 000 g/mol, more preferably less than 1 000 000 g/mol.

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Laundry compositions according to the current invention preferably comprise cationic polymer at a level selected from: less than 5 %, less than 2.5 %, and less than 2 %, by weight of the laundry composition. Silicone may be present at a level selected from: more than 0.05 %, more than 0.1 %, and more than 0.15 %, by weight of the  
5 composition. Suitably silicone is present in the composition in an amount selected from the range of from about 0.05 % to about 5 %, preferably from about 0.1 % to about 2.5 %, more preferably from about 0.15 % to about 2 %, by weight of the composition.

### **Anionic silicone emulsion**

10

The silicone of the present invention is an anionic silicone emulsion.

Silicones and their chemistry are described in, for example in The Encyclopaedia of Polymer Science, volume 11, p765.

15

Preferably the silicone is an anionic functionalised silicone. Examples of fabric softening anionic silicones suitable for the current invention include silicones containing the following functionalities; carboxylic, sulphate, sulphonc, phosphate, phosphonate functionality and mixtures thereof.

20

Preferably the anionic silicones of the current invention comprise silicones having a functionality selected from; carboxylic, sulphate, sulphonc, phosphate, phosphonate or mixtures thereof. More preferably the anionic silicone of the present invention comprises carboxylic functionality. Most preferably the anionic silicone of the current invention is a  
25 carboxyl silicone.

For the purposes of the current invention, the anionic silicone may be in the form of the acid or the anion. For example, for a carboxyl functionalised silicone, may be present as a carboxylic acid or carboxylate anion.

30

An example of a commercially available anionic functional material are: X22-3701E from Shin Etsu and Pecosil PS-100 from Pheonix Chemical.

Preferably the anionic silicone has an anionic group content of at least 1 mol%, preferably at least 2 mol%, by weight of the anionic silicone polymer.

5 The anionic group(s) on the anionic silicones of the present invention are preferably located in pendent positions on the silicone i.e. the composition comprises anionic silicones wherein the anionic group is located in a position other than at the end of the silicone chain. The terms 'terminal position' and 'at the end of the silicone chain' are used to indicate the terminus of the silicone chain.

10 When the silicones are linear in nature, there are two ends to the silicone chain. In this case the anionic silicone preferably contains no anionic groups located on a terminal position of the silicone.

15 When the silicones are branched in nature, the terminal position is deemed to be the two ends of the longest linear silicone chain. Preferably no anionic functionality is not located on the terminus of the longest linear silicone chain.

20 Preferred anionic silicones are those that comprise the anionic group at a mid-chain position on the silicone. Preferably the anionic group(s) of the anionic silicone are located at least five Si atoms from a terminal position on the silicone. Preferably the anionic groups are distributed randomly along the silicone chain.

25 The molecular weight of the silicone is preferably from 1,000 to 500,000 g/mol, more preferably from 2,000 to 250,000 g/mol even more preferably from 5,000 to 100,000 g/mol.

30 When the silicone is in an emulsion, the particle size can be 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).

Laundry compositions according to the current invention preferably comprise anionic silicone at a level selected from: less than 5 %, less than 2.5 %, and less than 2 %, by weight of the laundry composition. Silicone may be present at a level selected from: more than 0.05 %, more than 0.1 %, and more than 0.15 %, by weight of the  
5 composition. Suitably silicone is present in the composition in an amount selected from the range of from about 0.05 % to about 5 %, preferably from about 0.1 % to about 2.5 %, more preferably from about 0.15 % to about 2 %, by weight of the composition.

### 10 Dyes

The present invention comprises dyes having a low charge density. The dyes of the present invention have 1 to 4 anionic groups, more preferably 1 to 3 anionic groups. The anionic groups may be in the form of the acid or the anion. For example, for a sulphonic acid group, may be present as a sulphonic acid or sulphonate anion.

15 Examples of suitable such dyes include Acid Blue 3 / Patent Blue V85 (two sulphonic acid groups) and Direct Red 23 (two sulphonic acid groups).

The dye is preferably present in an amount less than 0.1 w.t. % of the formulation, more preferably less than 0.01 w.t. % of the formulation, even more preferably less than 0.005 w.t. %, most preferably less than 0.001 w.t. % of the formulation. The dye is preferably present in an amount more than 0.00001 w.t. % of the formulation.

### 25 Soluble complex

In the present invention, the cationic polymer and the anionic silicone form a soluble complex. A soluble complex is not a separate phase and is not a coacervate i.e. the compositions are homogeneous. Without wishing to be bound by theory, a soluble phase results in more even deposition of the silicone, particularly around each fibre and  
30 therefore improved softening. Improved softening may also be described as fabric care or fibre care. Not only is there improved deposition, there may also be reduced flocculation.

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By polymer/colloid complex we mean when one or multiple polymers are adsorbed onto a particle or emulsion colloidal surface, a soluble polymer/colloid complex is created. If these polymer/colloid complexes are not stabilized (i.e. if they are thermodynamically unstable) then they will diffuse together to form interpolymer/colloid complexes followed  
5 by aggregation and coacervation.

The soluble complex may be defined by its complex size. The complex is preferably smaller than 1 micron. More preferably the complex is smaller than 750 nm. Most preferably the complex is smaller than 500 nm. The complex size is the largest dimension  
10 of the complex. This can be measured under a microscope.

A soluble complex will not change the clarity of a complex. Clarity of a complex can be measured by absorbance using a UV-Visible spectrometer.

15 Absorbance is calculated using the following formula:

$$\text{Absorbance (A)} = -\log(T) = -\log(I_t / I_o)$$

$T$  = transmittance

$I_t$  = light intensity after the beam of light passes through the cuvette

20  $I_o$  = light intensity before the beam of light passes through the cuvette

Absorbance is measure using a 1cm cell and 500nm wavelength.

The formation of the soluble complex is the result of a balance of various features. In particular the ratio of anionic silicone to cationic polymer. The ratio may be between 10:1  
25 and 1:1, preferably the ratio is between 5:1 and 1:1, most preferably, the ratio is between 3:1 and 1:1.

The thermodynamic stability of polymer/colloid complexes, can be maintained by saturating the complex with surfactant micelles. This maintains solubility and inhibits  
30 interpolymer/colloid complexation within a concentrated surfactant environment ie a laundry product. Preferably, the ratio of surfactant to cationic polymer is between 2500:1 and 10:1, more preferably the ratio is between 1000:1 and 20:1, most preferably between 100:1 and 30:1. Preferably, the ratio of surfactant to anionic silicone is between 1250:1 and 5:1, more preferably 500:1 and 10:1, most preferably 100:1 and 20:1.

The cationic charge of the cationic polymer may have an influence on the formation of the soluble complex. Preferably the charge of the polymer is measured as the percentage of quaternary nitrogen in the polymer. Preferably there is less than 2.5 %, more preferably less than 2 % and most preferably less than 1.5 % quaternary nitrogen by weight of the polymer.

The molecular weight of the cationic polymer may have an influence on the soluble complex formation. Preferably the average molecular weight of the polymer is between 50 000 and 2 million g/mol, more preferably the average weight is between 100 000 and 1.5 million g/mol, most preferably the average weight is between 200 000 and 1 million g/mol.

Deposition is achieved at wash dilutions as micelles leave the polymer/colloid complex exposing sufficient polymer structure to allow for the soluble complex to deposit and adhere to the fibre as it diffuses through the fabric.

15

### **Product form**

The inventive compositions can take any of a number of forms of laundry compositions. Examples include powders, granules, bars, gels, serums and liquids.

20

Preferably the composition is in the form of a liquid laundry product. Preferably they are main wash products. The invention can take the form of a laundry composition for the main wash, which may be dilutable or non-dilutable.

25 A liquid laundry detergent according to the invention (may generally comprise from 5 to 95%, preferably from 10 to 90%, more preferably from 15 to 85% water (by weight based on the total weight of the composition)).

### **Surfactants**

30

The compositions of the present invention preferably comprise a surfactant.

The surfactant may be anionic, cationic, non-ionic and mixtures thereof.

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The laundry compositions of the present invention generally comprise at least 3 w.t.% surfactant, preferably at least 5 w.t.%, more preferably at least 8 w.t. %. Generally, the composition will comprise less than 60 w.t.% surfactant, more preferably less than 50 w.t.%, most preferably less than 40 w.t. % of one or more surfactants. Suitably the  
5 composition may comprise 3 to 60 w.t. %, more preferably 5 to 50 w.t. %, most preferably 8 to 40 w.t. % of one or more surfactants.

Preferably the surfactants are deterative surfactants, which may be selected from anionic surfactants, nonionic surfactants and mixtures thereof.

10

Anionic surfactants for use in the invention are typically salts of organic sulfates and sulfonates having alkyl radicals containing from about 8 to about 22 carbon atoms, the term "alkyl" being used to include the alkyl portion of higher acyl radicals. Examples of such materials include alkyl sulfates, alkyl ether sulfates, alkaryl sulfonates, alpha-olefin  
15 sulfonates and mixtures thereof. The alkyl radicals preferably contain from 10 to 18 carbon atoms and may be unsaturated. The alkyl ether sulfates may contain from one to ten ethylene oxide or propylene oxide units per molecule, and preferably contain one to three ethylene oxide units per molecule. The counterion for anionic surfactants is generally an alkali metal such as sodium or potassium; or an ammoniacal counterion  
20 such as monoethanolamine, (MEA) diethanolamine (DEA) or triethanolamine (TEA). Mixtures of such counterions may also be employed.

A preferred class of anionic surfactant for use in the invention includes alkylbenzene sulfonates, particularly linear alkylbenzene sulfonates (LAS) with an alkyl chain length of  
25 from 10 to 18 carbon atoms. Commercial LAS is a mixture of closely related isomers and homologues alkyl chain homologues, each containing an aromatic ring sulfonated at the "para" position and attached to a linear alkyl chain at any position except the terminal carbons. The linear alkyl chain typically has a chain length of from 11 to 15 carbon atoms, with the predominant materials having a chain length of about C12. Each alkyl  
30 chain homologue consists of a mixture of all the possible sulfophenyl isomers except for the 1-phenyl isomer. LAS is normally formulated into compositions in acid (i.e. HLAS) form and then at least partially neutralized in-situ.

Also suitable are alkyl ether sulfates having a straight or branched chain alkyl group having 10 to 18, more preferably 12 to 14 carbon atoms and containing an average of 1 to 3EO units per molecule. A preferred example is sodium lauryl ether sulfate (SLES) in which the predominantly C12 lauryl alkyl group has been ethoxylated with an average of 3EO units per molecule.

Some alkyl sulfate surfactant (PAS) may be used, such as non-ethoxylated primary and secondary alkyl sulphates with an alkyl chain length of from 10 to 18.

Preferred anionic surfactants are selected from: linear alkyl benzene sulphonates, sodium lauryl ether sulphonates with 1 to 3 moles (average) of ethoxylation, primary alkyl sulphonates, methyl ether sulphates and secondary alkyl sulphonates or mixtures thereof.

Mixtures of any of the above described materials may also be used. A preferred mixture of anionic surfactants for use in the invention comprises linear alkylbenzene sulfonate (preferably C<sub>11</sub> to C<sub>15</sub> linear alkyl benzene sulfonate) and sodium lauryl ether sulfate (preferably C<sub>10</sub> to C<sub>18</sub> alkyl sulfate ethoxylated with an average of 1 to 3 EO).

The total level of anionic surfactant in the present invention may suitably range from 5 to 30 w.t.%.

Nonionic surfactants for use in the invention are typically polyoxyalkylene compounds, i.e. the reaction product of alkylene oxides (such as ethylene oxide or propylene oxide or mixtures thereof) with starter molecules having a hydrophobic group and a reactive hydrogen atom which is reactive with the alkylene oxide. Such starter molecules include alcohols, acids, amides or alkyl phenols. Where the starter molecule is an alcohol, the reaction product is known as an alcohol alkoxyate. The polyoxyalkylene compounds can have a variety of block and heteric (random) structures. For example, they can comprise a single block of alkylene oxide, or they can be diblock alkoxyates or triblock alkoxyates. Within the block structures, the blocks can be all ethylene oxide or all propylene oxide, or the blocks can contain a heteric mixture of alkylene oxides. Examples of such materials include C<sub>8</sub> to C<sub>22</sub> alkyl phenol ethoxyates with an average of from 5 to 25 moles of ethylene oxide per mole of alkyl phenol; and aliphatic alcohol ethoxyates such as C<sub>8</sub> to

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C<sub>18</sub> primary or secondary linear or branched alcohol ethoxylates with an average of from 2 to 40 moles of ethylene oxide per mole of alcohol.

A preferred class of nonionic surfactant for use in the invention includes aliphatic C<sub>8</sub> to  
5 C<sub>18</sub>, more preferably C<sub>12</sub> to C<sub>15</sub> primary linear alcohol ethoxylates with an average of from 3 to 20, more preferably from 5 to 10 moles of ethylene oxide per mole of alcohol.

Mixtures of any of the above described materials may also be used.

10 The total level of nonionic surfactant in the present invention may suitably range from 0 to 25 w.t.%.

Examples of suitable mixtures of anionic and/or nonionic surfactants for use in the invention include mixtures of linear alkylbenzene sulfonate (preferably C<sub>11</sub> to C<sub>15</sub> linear  
15 alkyl benzene sulfonate) with sodium lauryl ether sulfate (preferably C<sub>10</sub> to C<sub>18</sub> alkyl sulfate ethoxylated with an average of 1 to 3 EO) and/or ethoxylated aliphatic alcohol (preferably C<sub>12</sub> to C<sub>15</sub> primary linear alcohol ethoxylate with an average of from 5 to 10 moles of ethylene oxide per mole of alcohol). The level of linear alkylbenzene sulfonate (preferably C<sub>11</sub> to C<sub>15</sub> linear alkyl benzene sulfonate) in such mixtures is preferably at  
20 least 50%, such as from 50 to 95% (by weight based on the total weight of the mixture).

Preferably the surfactant system is isotropic.

Where an anionic and a non-ionic surfactant are present in the laundry detergent, the  
25 weight ratio of anionic to nonionic surfactant may be from 5:1 to 1:1.5. Preferably the weight ratio of anionic to nonionic surfactant is from 5:1 to 1:1.25, more preferably from 4:1 to 1:1.25, even more preferably from 4:1 to 1:1.

### **Cosurfactants**

30

When deterative surfactants are present in the compositions of the present invention, the composition may further comprise one or more cosurfactants (such as amphoteric (zwitterionic) and/or cationic surfactants) in addition to the anionic and/or nonionic deterative surfactants described above.

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Specific cationic surfactants include C8 to C18 alkyl dimethyl ammonium halides and derivatives thereof in which one or two hydroxyethyl groups replace one or two of the methyl groups, and mixtures thereof. Cationic surfactant, when included, may be present in an amount ranging from 0.1 to 5% (by weight based on the total weight of the composition).

Specific amphoteric (zwitterionic) surfactants include alkyl amine oxides, alkyl betaines, alkyl amidopropyl betaines, alkyl sulphobetaines (sultaines), alkyl glycinate, alkyl carboxyglycinates, alkyl amphoacetates, alkyl amphopropionates, alkylamphoglycinates, alkyl amidopropyl hydroxysultaines, acyl taurates and acyl glutamates, having alkyl radicals containing from about 8 to about 22 carbon atoms, the term "alkyl" being used to include the alkyl portion of higher acyl radicals. Amphoteric (zwitterionic) surfactant, when included, may be present in an amount ranging from 0.1 to 5% (by weight based on the total weight of the composition).

Mixtures of any of the above described materials may also be used.

### **Builders**

When deterative surfactants are present in the compositions of the present invention, the composition may further comprise one or more builders. Builders enhance or maintain the cleaning efficiency of the surfactant. Builders for use in the invention can be of the organic or inorganic type, or a mixture thereof. Non-phosphate builders are preferred. Inorganic, non-phosphate builders for use in the invention are preferably selected from: hydroxides, carbonates, silicates, zeolites, and mixtures thereof.

The overall level of builder, when included, may range from about 0.1 to about 80%, preferably from about 0.5 to about 50% (by weight based on the total weight of the composition). Preferably the level of phosphate builders in a liquid laundry detergent of the invention is no more than 1%.

**Fatty Acid**

When deterative surfactants are present in the compositions of the present invention, the composition may further comprise one or more fatty acids and/or salts thereof.

5

Suitable fatty acids in the context of this invention include aliphatic carboxylic acids of formula RCOOH, where R is a linear or branched alkyl or alkenyl chain containing from 6 to 24, more preferably 10 to 22, most preferably from 12 to 18 carbon atoms and 0 or 1 double bond. Preferred examples of such materials include saturated C12-18 fatty acids such as lauric acid, myristic acid, palmitic acid or stearic acid; and fatty acid mixtures in which 50 to 100% (by weight based on the total weight of the mixture) consists of saturated C12-18 fatty acids. Such mixtures may typically be derived from natural fats and/or optionally hydrogenated natural oils (such as coconut oil, palm kernel oil or tallow). The fatty acids may be present in the form of their sodium, potassium or ammonium salts and/or in the form of soluble salts of organic bases, such as mono-, di- or triethanolamine. Mixtures of any of the above described materials may also be used.

10

15

Fatty acids and/or their salts, when included, may be present in an amount ranging from about 0.25 to 5%, more preferably from 0.5 to 5%, most preferably from 0.75 to 4% (by weight based on the total weight of the composition). For formula accounting purposes, in the formulation, fatty acids and/or their salts (as defined above) are not included in the level of surfactant or in the level of builder.

20

**Dye transfer inhibitors**

25

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 phthalocyanine, 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.

30

**Anti-redeposition polymers**

Anti-redeposition polymers are designed to suspend or disperse soil. Typically antiredeposition polymers are ethoxylated and or propoxylated polyethylene imine or  
5 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**

10 Examples of suitable soil release polymers include graft copolymers of poly(vinyl ester), e.g., C1 -C6 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  
15 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,  
20 Gerol, Marloquest, Cirrasol.

**Enzymes**

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

**Other ingredients**

30 When deterative surfactants are present in the compositions of the present invention, the compositions may comprise further ingredients typically found in fabric detergent compositions. Such materials include: transition metal ion chelating ingredients, hydrotropes, shading dyes, fluorescent agents, enzymes.

## Perfumes

The laundry compositions of the present invention may preferably comprise 0.1 to 15 w.t.% free perfume, more preferably 0.5 to 8 w.t. % free perfume.

5

Useful perfume components may include materials of both natural and synthetic origin. They include single compounds and mixtures. Specific examples of such components may be found in the current literature, e.g., in Fenaroli's Handbook of Flavor Ingredients, 1975, CRC Press; Synthetic Food Adjuncts, 1947 by M. B. Jacobs, edited by Van  
10 Nostrand; or Perfume and Flavor Chemicals by S. Arctander 1969, Montclair, N.J. (USA). These substances are well known to the person skilled in the art of perfuming, flavouring, and/or aromatizing consumer products.

Particularly preferred perfume components are blooming perfume components and  
15 substantive perfume components. Blooming perfume components are defined by a boiling point less than 250°C and a LogP or greater than 2.5. Substantive perfume components are defined by a boiling point greater than 250°C and a LogP greater than 2.5. Boiling point is measured at standard pressure (760 mm Hg). Preferably a perfume composition will comprise a mixture of blooming and substantive perfume components.

20

The perfume composition may comprise other perfume components.

It is commonplace for a plurality of perfume components to be present in a free oil perfume composition. In the compositions for use in the present invention it is envisaged that there will be three or more, preferably four or more, more preferably five or more,  
25 most preferably six or more different perfume components. An upper limit of 300 perfume components may be applied.

## Method

30

The compositions of the present invention may be used in a method for delivery of silicone to a fabric surface. This provides the benefit of softening which can also be described as fabric care or fibre care. Alternatively, the present invention may be used in a method of softening fabric.

It is preferred that the composition of the present invention is a detergent composition (i.e. comprises deterative surfactants), in which case, the method involves delivery of silicone to a fabric surface during the main wash of a laundry cycle.

## 5 Use

The composition of the present invention may be used for softening fabrics. Softening may be described as fabric care or fibre care.

## 10 Examples

Table 1: Laundry composition

<b>Ingredient</b>	<b>Fabric Cleaning Premix 1 (wt.%)</b>
Neodol 25_7	2.74
LAS acid	3.77
SLES (1EO)	3.91
Fatty Acid	0.5
Monopropylene glycol	0
Glycerol	0
Citric acid	0
Triethanolamine	0.33
Soil release polymer	0.55
EPEI	1.2
Optical brightener	0.03
Anionic silicone <sup>1</sup>	0.3
Cationic polymer <sup>2</sup>	0.15
NaOH	To pH 7.5
Dye	See below
Minors (enzymes, fragrance, , rheology modifier, preservatives)	<5
Water	To 100%

- 20 -

Active Silicone<sup>1</sup> - Silicone added as a 30% Silicone emulsion. The silicone comprised a carboxy group in a mid-chain pendent position ex. Wacker.

5 Cationic polymer<sup>2</sup> – UCare Polymer LR400 ex. Dow. This is a Polyquaternium-10 polymer.

Method of making the laundry composition:

10 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 silicone was added as an emulsion followed by the cationic polymer (LR400 added as an aqueous solution) solution, and any remaining components such as  
15 perfume, preservatives, dyes and silicones are added. Formulations with a number are according to the invention, formulations with a letter are comparative.

Dye solutions:

20 The following dye solutions were made up by mixing dye powder with deionised water, to make a 4.55 millimolar dye solution.

Table 2: 4.55 mM dye solutions

Dye	Charge on dye	% active	MW	Weight of dye	Volume of water	% weight of active	Molarity of active /mM
Direct Red 80	6	25	1373	0.5	19.5	0.625	4.55
Direct Yellow 50	4	40	956.82	0.218	19.782	0.436	4.56
Direct Red 23	2	30	813.72	0.2476	19.7779	0.371	4.56
Patent Blue V85	2	100	582.66	0.0536	19.9748	0.268	4.59

25 5 drops (21g) of each dye solution were added to 25g of detergent composition 1 (from table 1) and stirred.

- 21 -

Composition 2 - Detergent composition 1 and Direct yellow 50 solution

Composition 3 - Detergent composition 1 and Direct red 23 solution

Composition 2 - Detergent composition 1 and Patent Blue V85 solution

Composition A - Detergent composition 1 and Direct Red 80 solution

5

Table 3: Molarity of dyes in detergent composition 1

<b>Composition</b>	<b>Dye</b>	<b>Charge on dye</b>	<b>Number of drops of dye solution</b>	<b>amount of dye solution added /g</b>	<b>% weight of active</b>	<b>Molarity of active /mM</b>
A	Direct Red 80	6	5	0.21	0.024	0.038
2	Direct Yellow 50	4	5	0.21	0.017	0.038
3	Direct Red 23	2	5	0.21	0.014	0.038
4	Patent Blue V85	2	5	0.21	0.01	0.038

10

The resulting compositions were observed at x20 magnification under a light microscope in DIC mode. The results are provided in Table 4 and Figures 1 - 12. Bubbles were introduced into the samples to allow the microscope to focus in the homogeneous samples.

Table 4: Visual assessment under microscope

Composition	Dye	Charge on dye	Positive coacervate identification
A	Direct Red 80	6	Yes
1	Direct Yellow 50	4	No
2	Direct Red 23	2	No
3	Patent Blue V85	2	No

Figures:

Figures 1 and 2 – Direct yellow 50

Figures 3 and 4 – Direct red 23

15 Figures 5 and 6 – Patent Blue V85

Figures 7 to 12 - Direct Red 80

It can be clearly seen in figures 7 to 12 that the Direct Red 80 caused coacervates to form in the detergent compositions, whereas Direct Yellow 50 (figures 1 and 2), Direct Red 23 (figures 3 and 4) and Patent Blue V85 (figures 5 and 6) comprise a soluble complex.

20

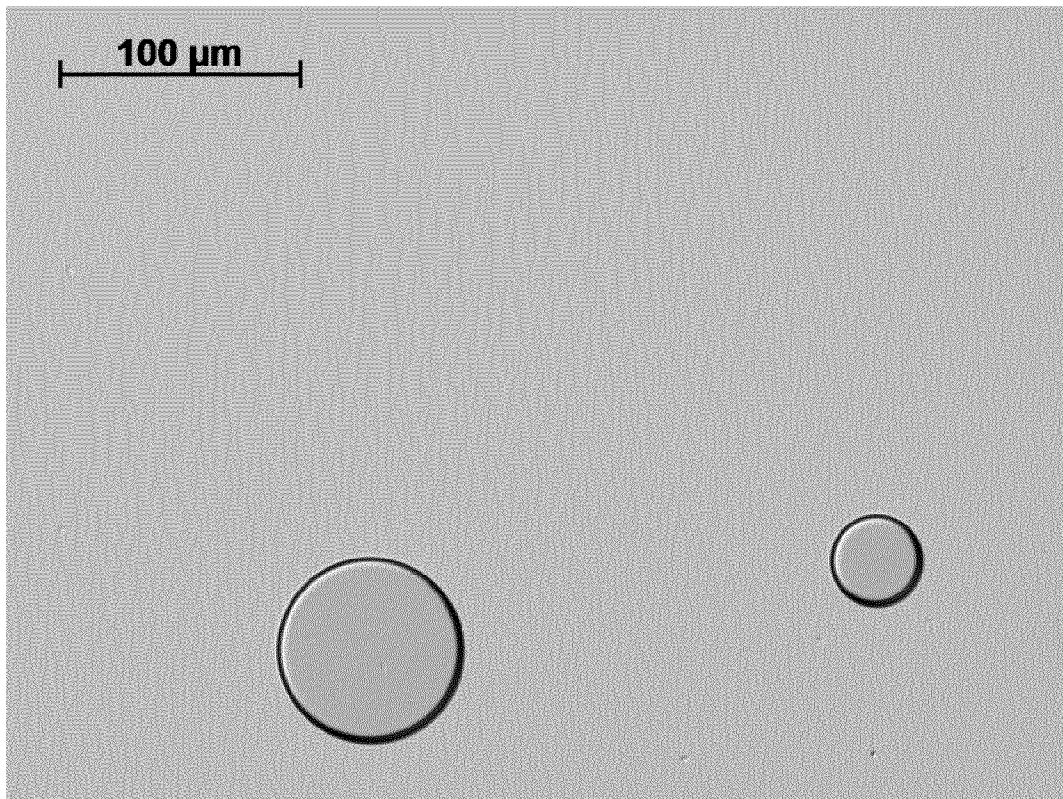
**CLAIMS**

1. A laundry composition comprising:
  - 5 a. Cationic polymer
  - b. Anionic silicone emulsion
  - c. Dye comprising 1 to 4 anionic groups; and
  - d. 3 to 60 % surfactant by weight of the compositionwherein the cationic polymer and anionic silicone form a soluble complex  
10 wherein the cationic polymer has a molecular weight of 20 000 to 2 000 000 g/mol.
2. A laundry composition according to Claim 1, wherein the soluble complex has a complex size of less than 1 micron.
- 15 3. A laundry composition according to any preceding claim, wherein the ratio of anionic silicone to cationic polymer is between 10:1 and 1:1.
4. A laundry composition according to any preceding claim, wherein the ratio of surfactant to cationic polymer between 2500:1 and 10:1.  
20
5. A laundry composition according to any preceding claim, wherein the surfactant is selected from an anionic and or/a non-ionic surfactant.
6. A laundry composition according to any preceding claim, wherein the composition  
25 comprises anionic and non-ionic surfactant.
7. A laundry composition according to any preceding claim, wherein the composition comprises 0.5 to 5 w.t.% anionic silicone.
- 30 8. A laundry composition according to any preceding claim, wherein the silicone is selected from the group consisting of silicones comprising functionalities selected from; carboxylic, sulphate, sulphonic, phosphate, phosphonate functionality and mixtures thereof.

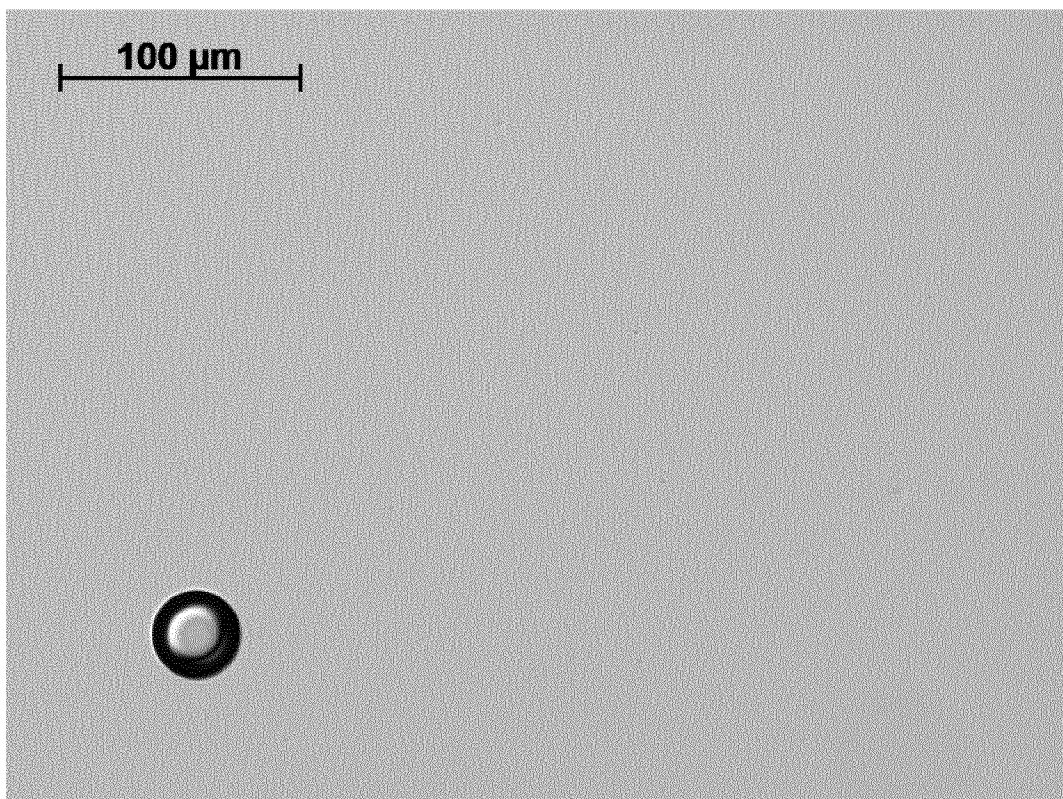
- 24 -

9. A laundry composition according to any preceding claim, wherein the silicone comprises carboxylic functionality.
- 5 10. A laundry composition according to any preceding claim, wherein the anionic silicone has an anionic group content of at least 1 mol%, by weight of the anionic silicone polymer.
11. A laundry composition according to any preceding claim, wherein the anionic groups on the anionic silicone are located in a pendent position.
- 10 12. A laundry composition according to any preceding claim, wherein the molecular weight of the silicone is from 1,000 to 500,000 g/mol.
13. A laundry composition according to any preceding claim, wherein the composition comprises 0.5 to 5 w.t.% anionic silicone.
- 15 14. A method of improving the delivery of silicone to a fabric surface, wherein a fabric is treated with a composition according to any preceding claim.
- 20 15. A use of a composition according to claims 1 to 13, for improving softening of fabrics.

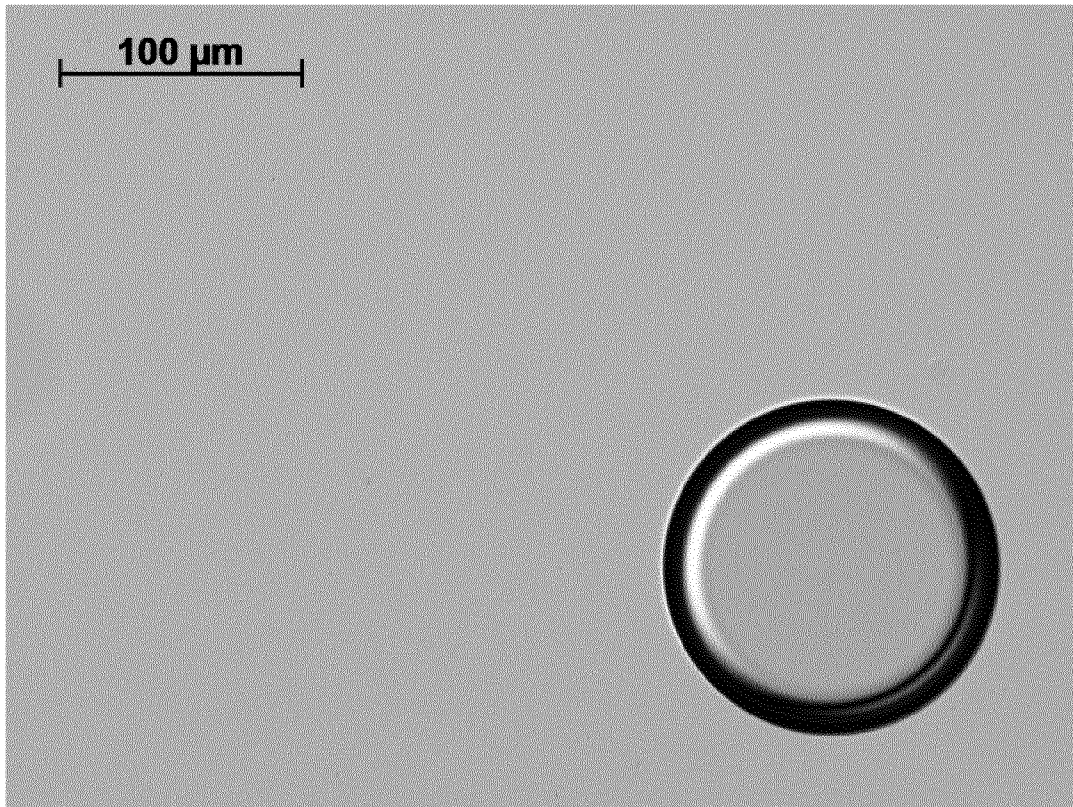
**Figure 1** - Detergent composition 1 and Direct yellow 50 solution, picture 1



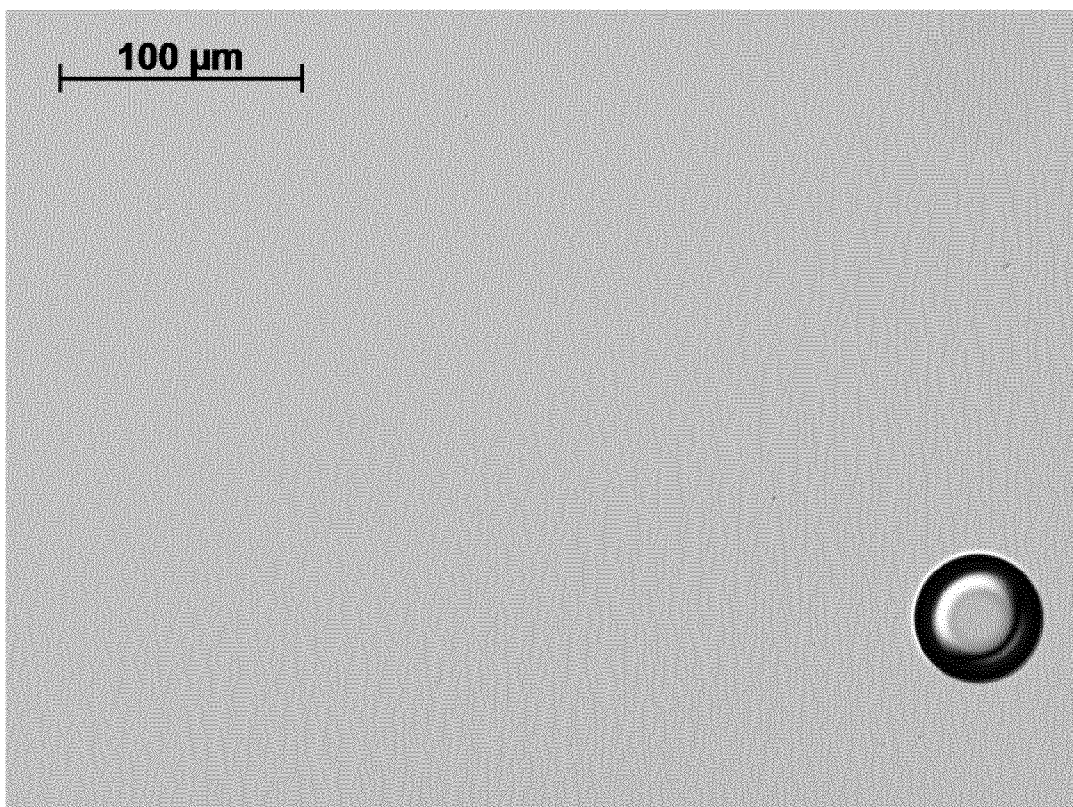
**Figure 2** - Detergent composition 1 and Direct yellow 50 solution, picture 2



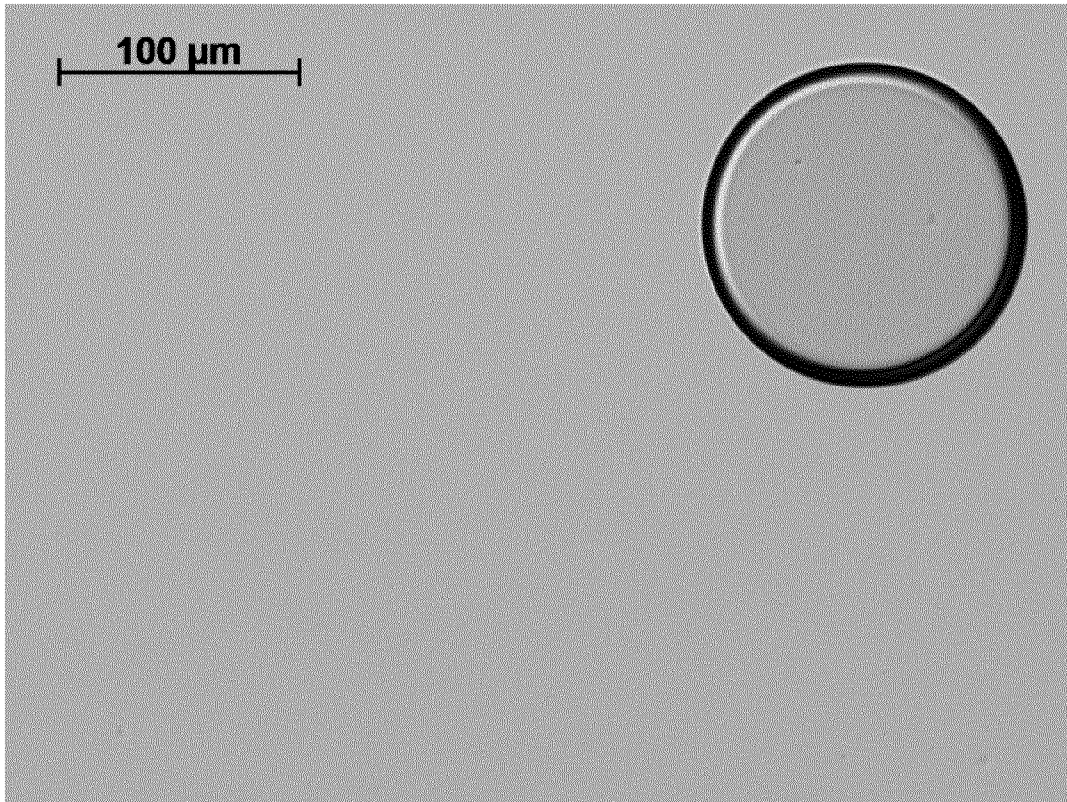
**Figure 3** - Detergent composition 1 and Direct red 23 solution, picture 1



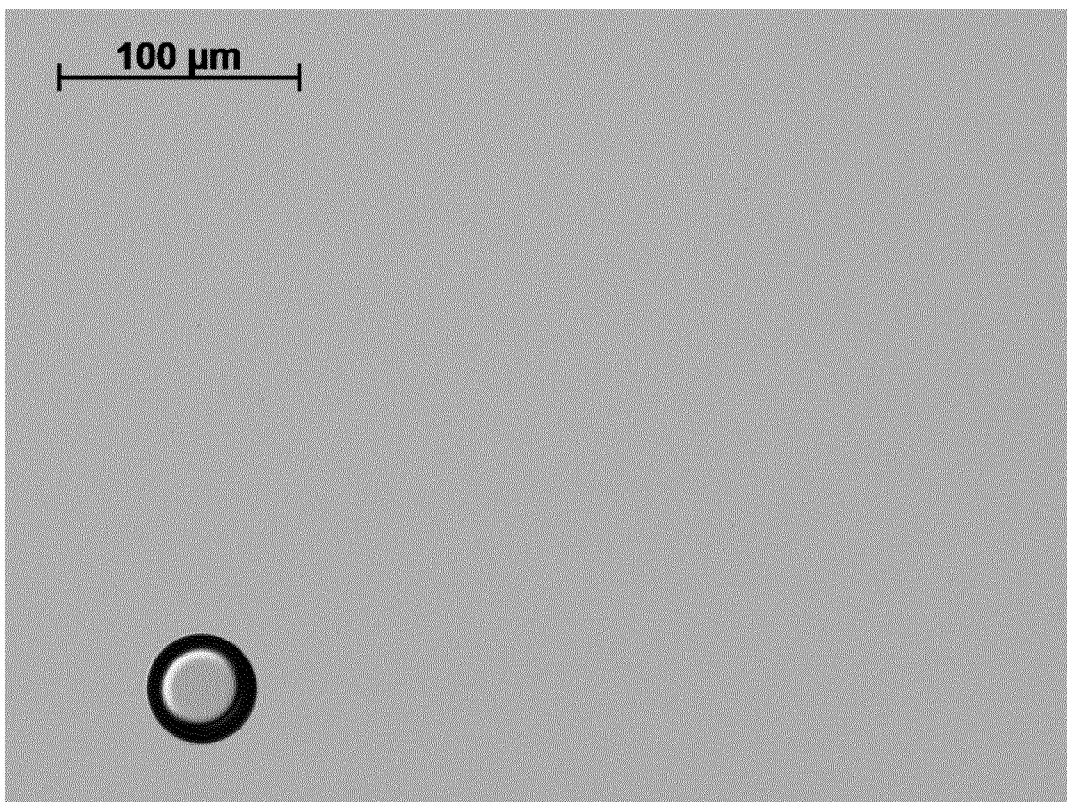
**Figure 4** - Detergent composition 1 and Direct red 23 solution, picture 2



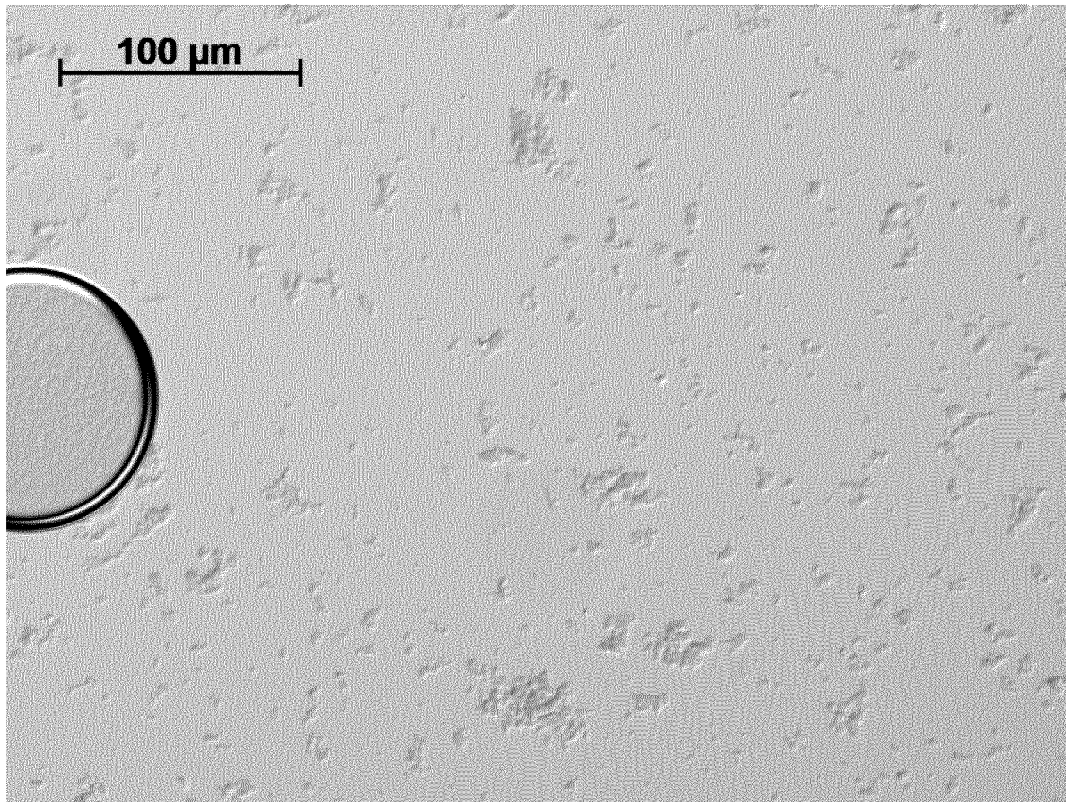
**Figure 5** - Detergent composition 1 and Patent Blue V85 solution, picture 1



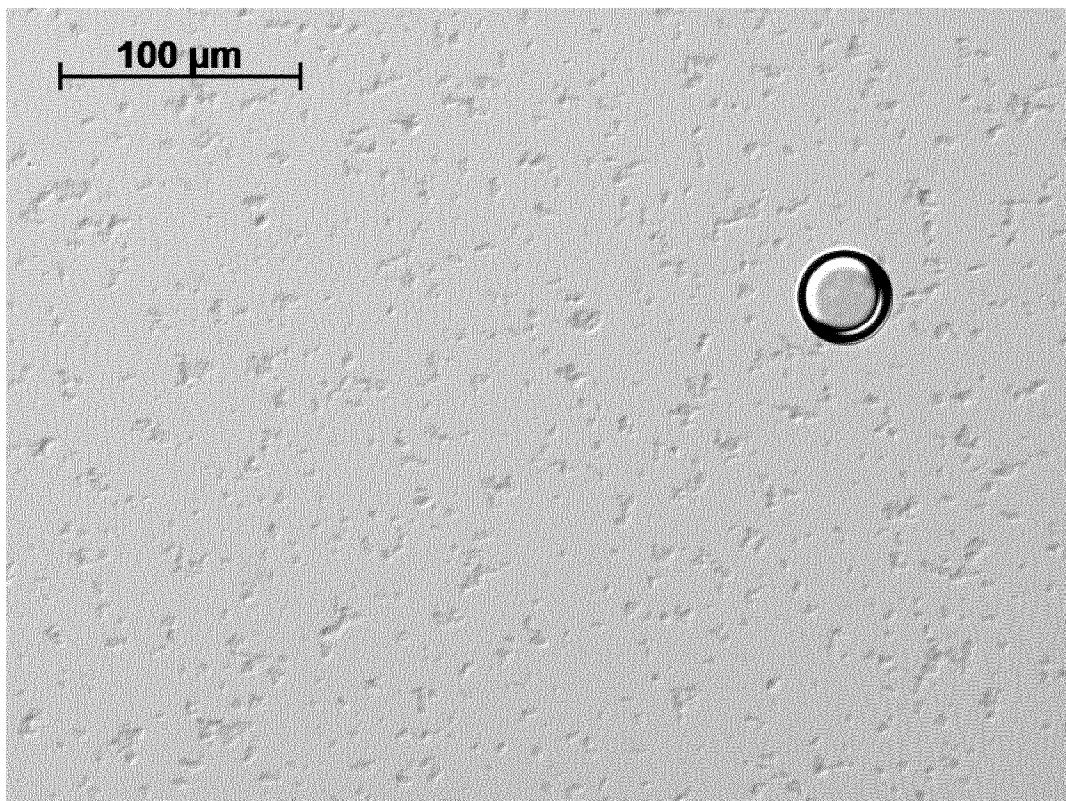
**Figure 6** - Detergent composition 1 and Patent Blue V85 solution, picture 2



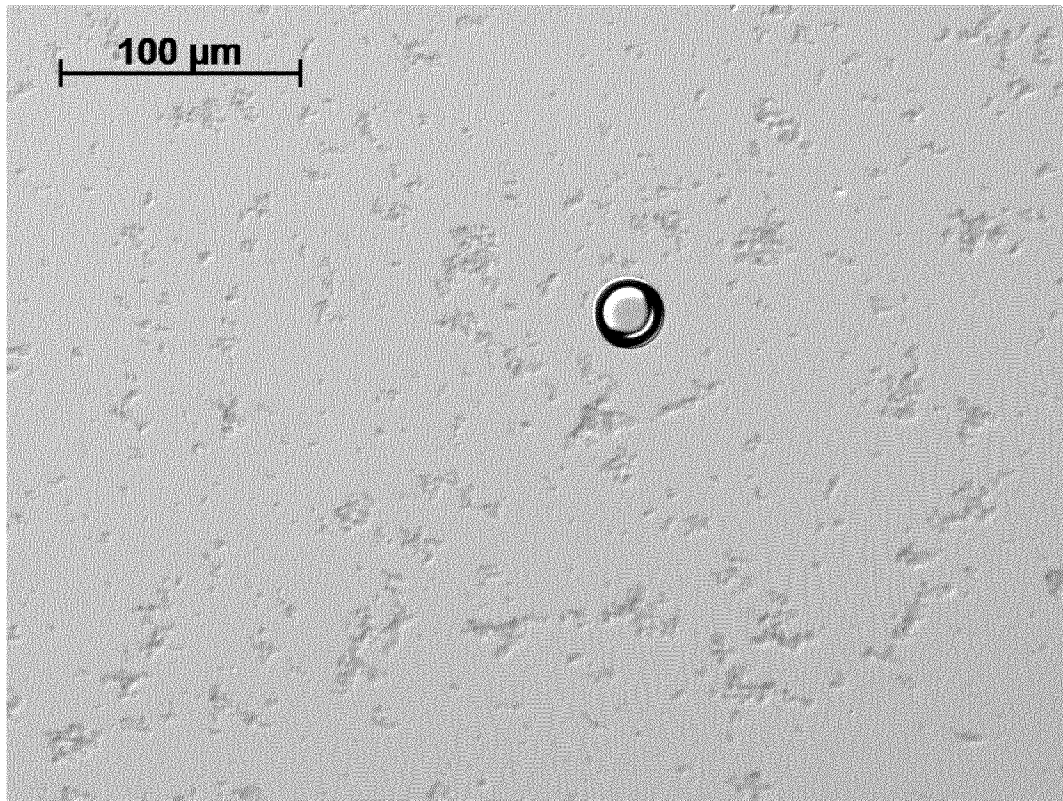
**Figure 7** - Detergent composition 1 and Direct red 80 solution, picture 1



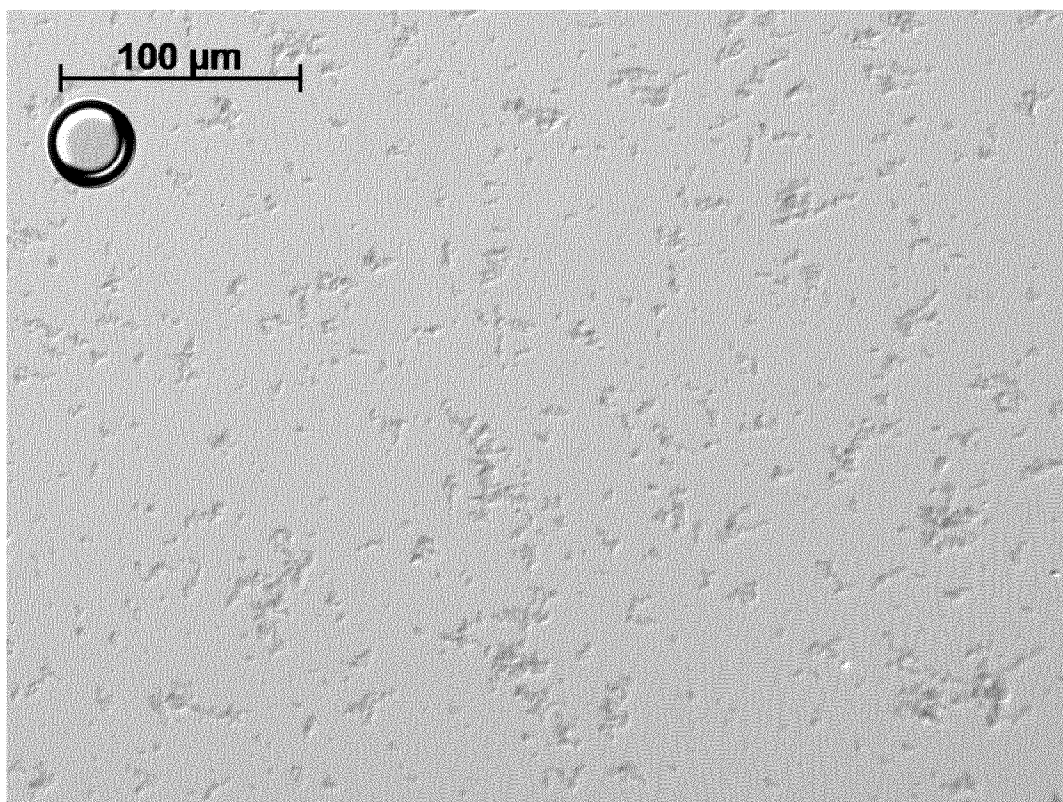
**Figure 8** - Detergent composition 1 and Direct red 80 solution, picture 2



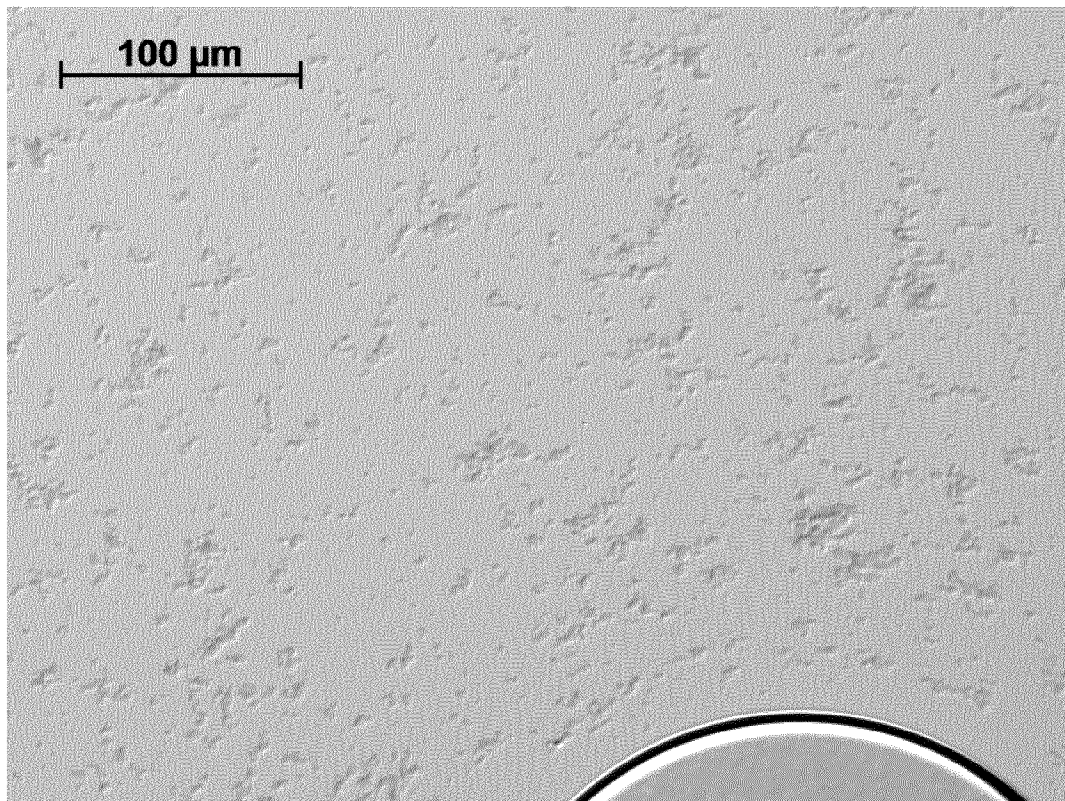
**Figure 9** - Detergent composition 1 and Direct red 80 solution, picture 3



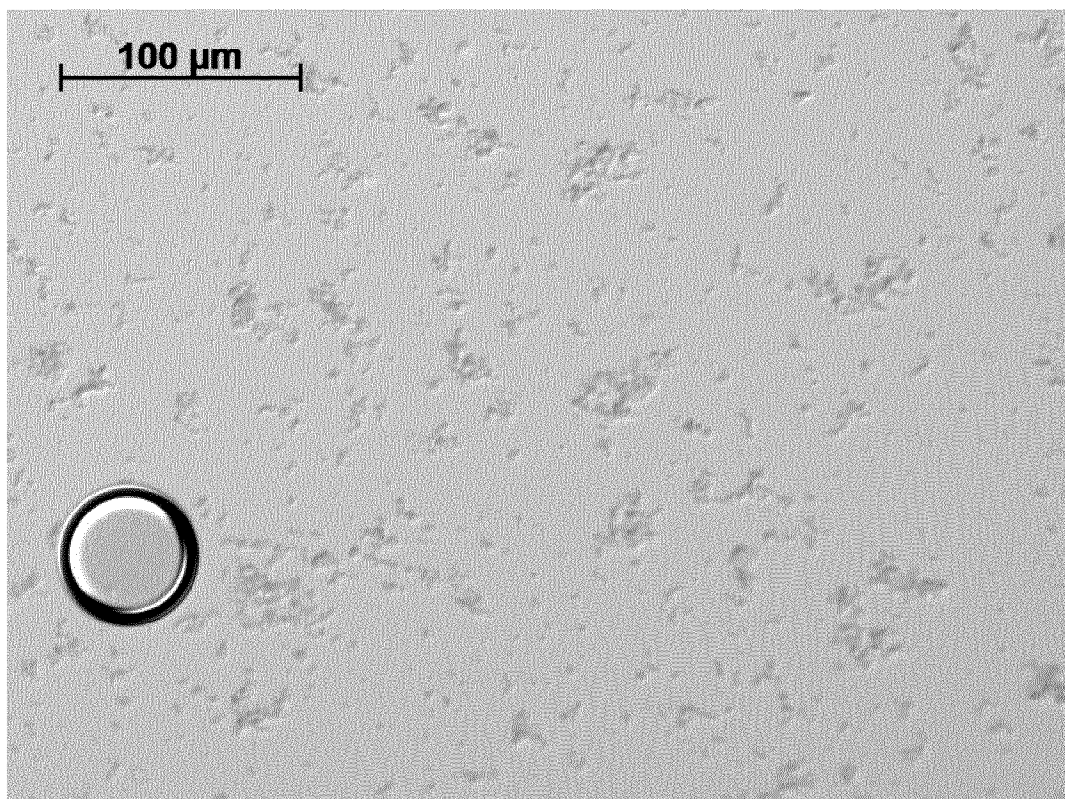
**Figure 10** - Detergent composition 1 and Direct red 80 solution, picture 4



**Figure 11** - Detergent composition 1 and Direct red 80 solution, picture 5



**Figure 12** - Detergent composition 1 and Direct red 80 solution, picture 6



INTERNATIONAL SEARCH REPORT

International application No  
PCT/EP2019/054832

A. CLASSIFICATION OF SUBJECT MATTER  
 INV. C11D3/00 C11D3/37 C11D3/40 C11D11/00 C11D1/83  
 C11D3/22  
 ADD.  
 According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED  
 Minimum documentation searched (classification system followed by classification symbols)  
 C11D  
 Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)  
 EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2015/078766 A1 (UNILEVER PLC [GB]; UNILEVER NV [NL]; CONOPCO INC DBA UNILEVER [US]) 4 June 2015 (2015-06-04) page 1, line 17 - line 18 page 3, line 22 - line 23 page 7, line 11 - last line page 9, line 28 - page 10, line 2 page 10, line 24 - page 11, line 7 page 15, line 12 - line 13 page 16 - page 22; claims 1, 6; tables 2, 5, 8; compounds 1-5 claims 2, 3, 5, 10 claim 13 ----- -/--	1-15

Further documents are listed in the continuation of Box C.

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
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- "&" document member of the same patent family

Date of the actual completion of the international search  26 April 2019	Date of mailing of the international search report  06/05/2019
Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Authorized officer  Cetinkaya, Murat

## INTERNATIONAL SEARCH REPORT

International application No  
PCT/EP2019/054832

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	<p>WO 2015/078764 A1 (UNILEVER PLC [GB]; UNILEVER NV [NL]; CONOPCO INC DBA UNILEVER [US]) 4 June 2015 (2015-06-04) page 1, line 5 - line 6 page 3, line 27 - line 28 page 7, line 5 page 7, line 15 - page 8, line 8 page 10, line 1 - line 5 page 13, line 1 - line 15 page 15, last line - page 16, line 1 page 16 - page 18; tables 1-3; compounds 1-6 page 19; table 4; compounds 1-6</p> <p style="text-align: center;">-----</p>	1-15
A	<p>WO 2015/078692 A1 (UNILEVER PLC [GB]; UNILEVER NV [NL]; CONOPCO INC DBA UNILEVER [US]) 4 June 2015 (2015-06-04) page 1, line 4 - line 5 page 3, line 25 - line 26 page 7, line 4 - line 18 page 15, line 4 - line 6 page 19; table 1; compounds A-F page 19, line 15 - page 20, line 5 page 20, line 21 - page 21, line 2</p> <p style="text-align: center;">-----</p>	1-15

# INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No PCT/EP2019/054832
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