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(54) Title: STABLE LIQUID DETERGENT COMPRISING SOIL RELEASE POLYMER

(57) Abstract: The present invention relates to a liquid detergent composition, in particular a heavy duty liquid detergent that is clear or translucent and aesthetically appealing and comprises Surfactant, propylene glycol, and at least one soil release polymer, as defined herein. The invention further relates to methods for washing of textiles using the detergents of the invention as well as the respective use thereof.



„Stable liquid detergent comprising soil release polymer“

The present invention relates to a liquid detergent composition, in particular a heavy duty liquid detergent (HDL) that is clear or translucent and aesthetically appealing and comprises surfactant, propylene glycol, and at least one soil release polymer. The invention further relates to methods for washing of textiles using the detergents of the invention as well as the respective use thereof.

Liquid detergent compositions are well-known in the art and widely used. Over recent years, they have become more and more popular with the consumers because they offer a number of advantages over solid compositions, including, for example, the ease of dosing, dispensing and dissolving into a laundering liquor. In addition, they are perceived to be safer and less harsh to the textiles and environment compared to solid compositions. In particular for laundering colored fabrics they have gained popularity ever since their introduction on the market. While advantageous with respect to ease of handling and consumer acceptance, many known compositions suffer from the drawback that they either have low contents of active ingredients, especially surfactants, or are comparably instable over extended periods of storage, i.e. they are prone to undergo phase separation or precipitation of some components over time. However, it would be highly desirable to have liquid detergent compositions available that simultaneously exhibit high compaction and long-term storage stability, as the high compaction allows for lesser weight and easier handling while the storage stability ensures that the product stays aesthetically pleasing even over extended periods of storage.

Thus, there is a need for sustainable liquid detergent compositions with high compaction which are long-term stable and meet high aesthetic standards. To fulfill this need is especially hard if the amount of anionic surfactant in the liquid detergent is to be higher than the amount of nonionic surfactant.

It has surprisingly been found by the inventors that the stability of a liquid detergent composition comprising relatively high amounts of synthetic surfactant and propylene glycol and at least one soil release polymer (SRP) is influenced not only by the amounts of the individual components but also their ratios with respect to each other. Specifically, it has been found that when synthetic anionic surfactants, synthetic nonionic surfactants, propylene glycol and SRPs are used within predetermined concentration ranges, highly concentrated, clear or translucent detergent products that meet the above need can be provided.

Thus, in a first aspect, the present invention relates to an aqueous liquid detergent composition comprising, relative to the total weight of the liquid detergent composition, 15 wt.% to 45 wt.%, preferably 32 wt.% to 35 wt.%, of non-soap surfactant; 0.5 wt.% to 50 wt.%, preferably 10 wt.% to 20 wt.%, of propylene glycol; 0.01 wt.% to 10 wt.%, preferably 0.9 wt.% to 2.5 wt.%, of at least one soil release polymer (SRP); and up to 84.49 wt.%, preferably 5 wt.% to 35 wt.%, more preferably 15 wt.% to 25 wt.%, water; wherein the weight ratio of non-soap anionic surfactant to nonionic surfactant is at least 1.2, preferably at least 1.25; and wherein the composition meets the requirement:

$$X = a + b \cdot B + c \cdot C + d \cdot D + e \cdot E + f \cdot F + g \cdot B \cdot C + h \cdot E \cdot F,$$

wherein

a is -25 to -20;

b is 0.6 to 0.8, preferably 0.73 to 0.79;

B is the concentration of surfactant in wt.% relative to the total weight of the composition;

c is 0.6 to 1.3, preferably 0.78 to 1.12;

C is the concentration of propylene glycol in wt.% relative to the total weight of the composition;

d is 0.6 to 1.2, preferably 0.74 to 1.0;

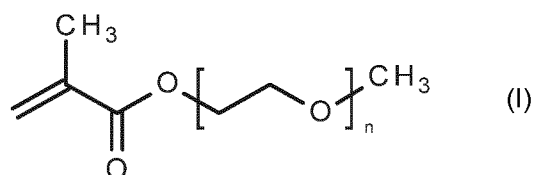
D is the concentration of a polyester type SRP based on terephthalic acid and ethylene and/or propylene glycol with a molecular weight  $M_w < 4000$  in wt.% relative to the total weight of the composition;

e is 0.8 to 7.0, preferably 1.1 to 5.5;

E is the concentration of a polyester type SRP based on terephthalic acid and ethylene and/or propylene glycol with a molecular weight  $M_w \geq 4000$  in wt.% relative to the total weight of the composition;

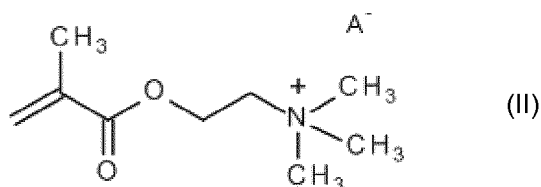
f is 1.2 to 2.3, preferably 1.6 to 1.9;

F is the concentration of a polymer, obtainable by radical copolymerisation of at least one monomer of formula (I),



in which n is a number equal to or larger than 3, preferably a number in the range of from 3 to 120, more preferred a number in the range of from 5 to 50 and most preferred a number in the range of from 7 to 46, and in embodiments of the invention n is selected from the group encompassing the numbers 7, 23, and 46,

with at least one monomer of formula (II),



in which  $A^-$  is an anion, preferably selected from the group encompassing halides, such as fluoride, chloride, bromide, iodide, sulfate, hydrogensulfate, alkylsulfate, such as methylsulfate, and their mixtures, in wt.% relative to the total weight of the composition;

g is -0.1 to 0, preferably -0.04 to -0.03;

h is -4 to 1, preferably -3 to -0.1, more preferably -1.5 to -1.0; and

X is an indicator for the stability of the composition and is up to 3, preferably up to 2, and most preferably in the range of from 1 to 2;

and wherein the composition meets the requirement

(a)  $15 < -(a+b+c+d+e+g+h-1) < 25$ , preferably  $19 < -(a+b+c+d+e+g+h-1) < 22$ , more preferably  $-(a+b+c+d+e+g+h-1)$  is about 20.6; and/or

(b)  $-5 < -(a+(b \cdot B)+(c \cdot C)+(d \cdot D)+(e \cdot E)+(g \cdot B \cdot C)+(h \cdot E \cdot F)-1) < 5$ , preferably  $-1 < -(a+(b \cdot B)+(c \cdot C)+(d \cdot D)+(e \cdot E)+(g \cdot B \cdot C)+(h \cdot E \cdot F)-1) < 1$ , more preferably

$-(a+(b \cdot B)+(c \cdot C)+(d \cdot D)+(e \cdot E)+(g \cdot B \cdot C)+(h \cdot E \cdot F)-1)$  is about -0.1; and/or

(c)  $12 < -(a+b+c+d+e+f+g-1) < 23$ , preferably  $16 < -(a+b+c+d+e+f+g-1) < 19$ , more preferably  $-(a+b+c+d+e+f+g-1)$  is about 17.6; and/or

(d)  $-4 < -(a+(b \cdot B)+(c \cdot C)+(d \cdot D)+(e \cdot E)+(f \cdot F)+(g \cdot B \cdot C)-1) < 0$ , preferably  $-3 < -(a+(b \cdot B)+(c \cdot C)+(d \cdot D)+(e \cdot E)+(f \cdot F)+(g \cdot B \cdot C)-1) < -1$ , more preferably

$-(a+(b \cdot B)+(c \cdot C)+(d \cdot D)+(e \cdot E)+(f \cdot F)+(g \cdot B \cdot C)-1)$  is about -2.0.

In the calculation of X it is important to enter the values of B, C, D, E, and F as decimals, for example "23 %" as "0.23", into the given formula.

The compositions preferably comprise at least one SRP given at the definitions of D, E, and F, and preferably are free of any other SRPs but those given at the definitions of D, E, and F.

The compositions normally are translucent if they at least meet the requirement

(a)  $16 < -(a+b+c+d+e+g+h-1) < 26$ , preferably  $20 < -(a+b+c+d+e+g+h-1) < 23$ , more preferably  $-(a+b+c+d+e+g+h-1)$  is about 21.6; and/or

(b)  $-4 < -(a+(b \cdot B)+(c \cdot C)+(d \cdot D)+(e \cdot E)+(g \cdot B \cdot C)+(h \cdot E \cdot F)-1) < 6$ , preferably  $0 < -(a+(b \cdot B)+(c \cdot C)+(d \cdot D)+(e \cdot E)+(g \cdot B \cdot C)+(h \cdot E \cdot F)-1) < 2$ , more preferably

$-(a+(b \cdot B)+(c \cdot C)+(d \cdot D)+(e \cdot E)+(g \cdot B \cdot C)+(h \cdot E \cdot F)-1)$  is about 0.9; and/or

(c)  $13 < -(a+b+c+d+e+f+g-1) < 24$ , preferably  $17 < -(a+b+c+d+e+f+g-1) < 20$ , more preferably  $-(a+b+c+d+e+f+g-1)$  is about 18.6; and/or

- (d)  $-3 < -(a+(b \cdot B)+(c \cdot C)+(d \cdot D)+(e \cdot E)+(f \cdot F)+(g \cdot B \cdot C)-1) < 1$ , preferably  $-2 < -(a+(b \cdot B)+(c \cdot C)+(d \cdot D)+(e \cdot E)+(f \cdot F)+(g \cdot B \cdot C)-1) < 0$ , more preferably  $-(a+(b \cdot B)+(c \cdot C)+(d \cdot D)+(e \cdot E)+(f \cdot F)+(g \cdot B \cdot C)-1)$  is about  $-1.0$ .

Compositions meeting this requirement are preferred embodiments of the invention.

Smaller values of X mean higher stabilities of the composition. The stability value X of a composition according to the invention may also be determined by optical grading of at least two experimentalists by using a scale from 1 to 10 with 1 being the best and 10 being the worst grade:

- 1: one phase, clear
- 2: one phase, translucent
- 3: one phase, slightly turbid
- 4: one phase, turbid
- 5: small phase separation; upper phase turbid
- 6: > 25 vol% of total filling height phase separation; upper phase turbid
- 7: 2 separate liquid phases
- 8: 2 separate liquid phases; > 25 vol% of total filling height phase separation; precipitation at the bottom
- 9: 2 separate liquid phases; precipitation at the bottom
- 10: more than 2 liquid and 1 solid phases.

If X of a composition is calculated according to the formula given above, values below 1 and even negative values may result. Those compositions will be graded with X = 1 when X is determined by optical grading of at least two experimentalists by using the scale given above.

A further aspect of the invention is a method of producing a stable aqueous liquid detergent composition, comprising the components given above in the amounts also given, by mixing the components in amounts that meet the requirement stated above.

In a further aspect, the invention relates to methods for cleaning textiles, wherein textiles are contacted with a washing liquor containing the liquid detergent composition of the present invention in at least one step of a washing process.

In a still further aspect, the invention also covers the use of a detergent composition as defined herein for the cleaning/washing of textiles.

“At least one”, as used herein, relates to one or more, i.e. 1, 2, 3, 4, 5, 6, 7, 8, 9, or more. If used in combination with a compound, the term does not relate to the absolute number of molecules but rather to the number of different types of said compound. “At least one surfactant” thus means that at least one type but that also 2 or more different surfactant types can be present.

“About”, as used herein in relation to a numerical value, relates to said value  $\pm 10\%$ , preferably  $\pm 5\%$ . “About 2.0” thus refers to a range from 1.8 to 2.2, preferably from 1.9 to 2.1.

If not indicated otherwise, all percentages refer to active matter and are by weight relative to the total weight of the composition.

“Free of”, as used herein in relation to a specific type of component, means that the referenced composition does not contain more than 0.5 wt.%, preferably no more than 0.1 wt.%, more preferably no more than 0.05 wt.% of said component relative to the total weight of the composition. Most preferably, said component is not contained at all.

The detergent compositions of the present invention can be used as detergents for textiles, carpets or natural fibers or fabric conditioners. In preferred embodiments, the detergents disclosed herein are heavy duty liquid (HDL) detergents.

In various embodiments, the liquid detergent may be an aqueous liquid detergent and contain water, typically in substantial amounts, such as up to 40 wt.%, preferably 10 to 30 wt.%. The compositions disclosed herein can be provided in a higher compacted form compared to established compositions and thus less amount of liquid detergent is needed for the same washing performance. The liquid detergent may be a phosphate-free detergent and/or may be a structured liquid detergent.

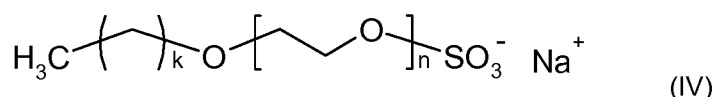
The detergent compositions of the invention comprise non-soap surfactant of the anionic and of the nonionic type. Said anionic surfactant is comprised of at least one, preferably at least two different anionic surfactants. In various preferred embodiments, the surfactant comprises at least one alkyl ether sulfate. Preferred alkyl ether sulfates are those of formula (III)



In formula (III)  $R^1$  represents a linear or branched, substituted or unsubstituted alkyl group, preferably a linear, unsubstituted alkyl group, more preferably a fatty alcohol moiety. Preferred  $R^1$  moieties are selected from the group consisting of decyl, undecyl, dodecyl, tridecyl, tetradecyl, pentadecyl, hexadecyl, heptadecyl, octadecyl, nonadecyl, eicosyl moieties and mixtures thereof, wherein those groups with an even number of carbon atoms are preferred. Particularly preferred  $R^1$  moieties are derived from  $C_{10}$ - $C_{18}$  fatty alcohols, such as those derived from coconut oil alcohols, tallow fatty alcohols, lauryl, myristyl, cetyl or stearyl alcohol or from  $C_{10}$ - $C_{20}$  oxoalcohols.

AO represents an ethyleneoxide (EO) or propyleneoxide (PO) group, preferably an ethyleneoxide group. The index n represents an integer from 1 to 50, preferably from 1 to 20 and more preferably from 1 to 10. Particularly preferably, n is 1, 2, 3, 4, 5, 6, 7 or 8. X represents a monovalent cation or the n-th part of an n-valent cation, preferred are alkali metal cations, specifically Na<sup>+</sup> and K<sup>+</sup>, most preferably Na<sup>+</sup>. Further cations X<sup>+</sup> may be selected from NH<sub>4</sub><sup>+</sup>, ½ Zn<sup>2+</sup>, ½ Mg<sup>2+</sup>, ½ Ca<sup>2+</sup>, ½ Mn<sup>2+</sup>, and combinations thereof.

In various preferred embodiments, the detergent compositions comprise an alkyl ether sulfate selected from fatty alcohol ether sulfates of formula (IV)

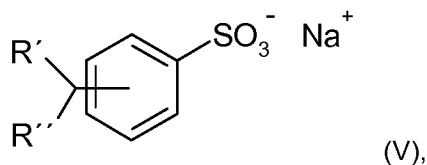


wherein k = 9 to 19, and n = 1, 2, 3, 4, 5, 6, 7 or 8. Preferred are C<sub>10-16</sub> fatty alcohol ether sulfates with 1-7, more preferably 1-3 EO (k = 9-15, n = 1-7, 1-3), even more preferred the C<sub>12-14</sub> fatty alcohol ether sulfates with 1-3, particularly 2 EO (k = 11-13, n = 1-3 or 2), more particularly the sodium salts thereof. Particularly preferred is lauryl ether sulfate sodium salt with 2 EO. The level of ethoxylation is an average value and can, for a specific compound, be an integer or fractional number.

The alkyl ether sulfate is preferably contained in the compositions of the invention in an amount of 3 to 8 wt.% relative to the total weight of the composition, more preferably 3.2 to 7 wt.%, even more preferably 4.5 to 7 wt.%, most preferably 5 to 6 wt.%.

In preferred embodiments of the invention, the surfactant comprises at least one alkyl benzene sulfonate. Said alkyl benzene sulfonate may be included alternatively to the above alkyl ether sulfate or, preferably, in addition to it.

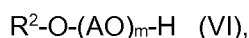
Exemplary alkyl benzene sulfonates include, but are not limited to linear and branched alkyl benzene sulfonates, preferably linear alkyl benzene sulfonates. Exemplary compounds are those of formula (V)



wherein R' and R'' are independently H or alkyl and combined comprise 9 to 19, preferably 9 to 15 and more preferably 9 to 13 carbon atoms. Particularly preferred are dodecyl and tridecyl benzene sulfonates, in particular the sodium salts thereof. Preferred contents of the alkyl benzene

sulfonates range from 10 to 20 wt.%, preferably 11 to 17 wt.%, more preferably 12 to 16 wt.% relative to the total weight of the composition.

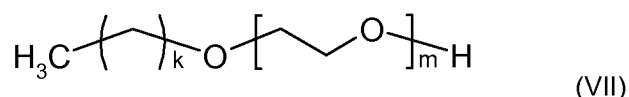
In addition, the compositions of the invention further comprise one or more nonionic surfactants. Preferred nonionic surfactants are those of formula (VI)



wherein  $R^2$  represents a linear or branched substituted or unsubstituted alkyl moiety, AO represents an ethylene oxide (EO) or propylene oxide (PO) group and m is an integer from 1 to 50. In formula (VI)  $R^2$  preferably represents a linear or branched, substituted or unsubstituted alkyl group, preferably a linear, unsubstituted alkyl group, particularly preferred a fatty alcohol group. Preferred groups are  $R^2$  are selected from decyl, undecyl, dodecyl, tridecyl, tetradecyl, pentadecyl, hexadecyl, heptadecyl, octadecyl, nonadecyl, eicosyl groups and combinations thereof, wherein those groups with an even number of carbon atoms are preferred. Particularly preferred are  $R^2$  groups derived from  $C_{12}$ - $C_{18}$  fatty alcohols, such as coconut oil alcohol, tallow oil alcohol, lauryl, myristyl, cetyl or stearyl alcohol or from  $C_{10}$ - $C_{20}$  oxoalcohols.

AO represents an ethyleneoxide (EO) or propyleneoxide (PO) group, preferably an ethyleneoxide group. The index m represents an integer from 1 to 50, preferably from 1 to 20 and more preferably from 1 to 12.

In various embodiments, the detergent compositions comprise an alkyl ether selected from fatty alcohol ethers of formula (VII)



wherein  $k = 11$  to  $19$ ,  $m = 1$ - $12$ . Preferred are  $C_{12-18}$  fatty alcohols with 1-12 EO ( $k = 11$ - $17$ ,  $m = 1$ - $12$  in formula (VII)). More preferred are  $C_{12-18}$  alkyl ethers having 7 EO. Such nonionic alkyl ethers may be contained in the formulation in amounts of 10 to 20 wt.%, preferably 11 to 18 wt.%, more preferably 12 to 17 wt.%.

The detergents may further include other anionic, nonionic, amphoteric or zwitterionic surfactants, such as alkyl glucosides, betaines, aminoxides and the like.

In also preferred embodiments of the invention, the surfactant comprises at least two anionic surfactants, namely at least one alkyl ether sulfate and preferably at least one alkyl benzene sulfonate, and at least one alkyl ether.

The compositions comprise 15 to 45, preferably 32 to 35 wt.% of non-soap surfactant. Said non-soap surfactant comprises anionic surfactant, preferably (1) 3 to 8 % wt.%, preferably 4.5 to 7 wt.% alkyl ether sulfates, preferably C<sub>10-16</sub> alkyl ether sulfates with 1 to 7 EO, more preferably C<sub>12-14</sub> fatty alcohol ether sulfates with 1-3 EO, most preferably lauryl ether sulfate with 2 EO; (2) 10 to 20, preferably 11 to 17 wt.%, more preferably 12 to 16 wt.% of a linear alkyl benzene sulfonate, preferably dodecyl or tridecyl benzene sulfonate. In addition, said non-soap surfactant comprises at least one nonionic surfactant; preferred embodiments additionally include (3) 10 to 20, preferably 11 to 18 wt.%, more preferably 12 to 17 wt.% of alkyl ether, preferably a C<sub>12-18</sub> fatty alcohol with 1-12 EO, more preferably a C<sub>12-18</sub> fatty alcohol with 7 EO. The weight ratio of non-soap anionic surfactant to nonionic surfactant may be up to any value one wishes, preferably is up to 5, more preferably up to 5 and most preferred up to 2.5, for example up to 1.5. All afore-mentioned percentages relate to the total weight of the composition, as will all percentages mentioned below, unless expressly stated otherwise.

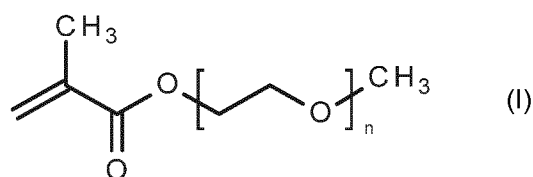
Further, the liquid detergent composition comprises 0.5 to 50 wt.%, preferably 10 to 20 wt.%, more preferably 12 to 15 wt.% propylene glycol, relative to the total weight of the liquid detergent composition. "Propylene glycol", as used herein, refers to propane-1,2-diol. The compositions may comprise further organic solvents, in particular alcohols or polyols, such as other diols or triols, preferably glycerol.

"Soil release polymers", as used herein, are polymers having soil release properties, i.e. having the property to enhance the cleaning efficacy of the cleaning composition by improving release of greasy and oil during the laundry process.

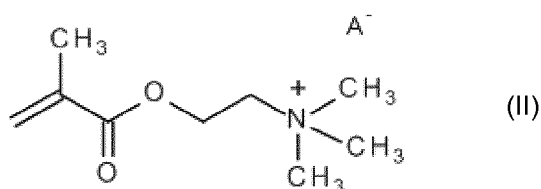
The at least one soil release polymer is contained in 0.01 to 10 wt.%, preferably 0.9 to 2.5 wt.% in the liquid detergent composition relative to the total weight of the composition. Suitable soil release polymers that can be used in accordance with the present invention include nonionic polymeric polyesters, in particular those based on terephthalic acid and ethylene or propylene glycol. Such polymers include polyethylene terephthalates, polypropylene terephthalates and copolymers thereof, such as polyethylene terephthalate/polyoxyethylene terephthalate copolymers. In preferred embodiments, the at least one soil release polymer comprises a nonionic polyester based on terephthalic acid and 1,2-propylene glycol, preferably endcapped with polyethylene glycol or alkoxy-capped polyethylene glycol. These include the soil release polymers commercially available from Clariant under the tradename Texcare®, in particular Texcare® SRN 170 (terephthalic acid/propylene glycol polyester polymer endcapped with methoxy PEG 750; M<sub>w</sub> about 2700) and Texcare® SRN 240 (terephthalic acid/propylene glycol polyester polymer endcapped with methoxy PEG 2000; M<sub>w</sub> about 6200). In various embodiments, the detergent composition comprises at least one of these nonionic polyesters based on terephthalic acid and 1,2-propylene glycol, preferably

endcapped with polyethylene glycol or alkoxy-capped polyethylene glycol, more preferably endcapped with methoxy PEG, such as Texcare® SRN 170 or 240. In certain embodiments, two or more of said SRPs can be used in combination, including a combination of Texcare® SRN 170 and 240.

It has surprisingly been found that type and amount of soil release polymer as well as the specific combination of different SRPs additionally influence composition stability in that they can synergistically interact with each other with regard to stability. Accordingly, the compositions comprise at least one polymeric polyester based on terephthalic acid and ethylene or propylene glycol, in particular based on terephthalic acid and propylene glycol. In preferred embodiments, they comprise (1) at least one SRP based on terephthalic acid and propylene glycol with a molecular weight  $M_w$  of less than 4000 g/mol, such as Texcare® SRN 170; (2) at least one SRP based on terephthalic acid and propylene glycol with a molecular weight  $M_w$  of equal to or more than 4000 g/mol, such as Texcare® SRN 240; and/or (3) at least one polymer, obtainable by radical copolymerisation of at least one monomer of formula (I),

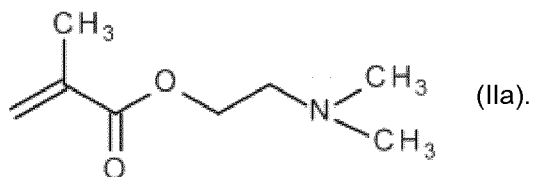


in which  $n$  is a number equal to or larger than 3, preferably for a number in the range of from 3 to 120, more preferred for a number in the range of from 5 to 50 and most preferred for a number in the range of from 7 to 46, and in embodiments of the invention  $n$  is selected from the group encompassing the numbers 7, 23, and 46, with at least one monomer of formula (II),



in which  $\text{A}^-$  is an anion, preferably selected from the group encompassing halides, such as fluoride, chloride, bromide, iodide, sulfate, hydrogensulfate, alkylsulfate, such as methylsulfate, and their mixtures. Particularly preferred are combinations of (1) and (3), (2) and (3) and (1), (2) and (3), more preferred are combinations of (1) and (3), and (2) and (3), most preferred is a combination of (2) and (3). Preferably polymers (3) are obtainable by copolymerization of monomers according to formula (I) and monomers according to formula (II) in a molar ratio in the range of from 1:99 to 75:25, more preferred in the range of from 5:95 to 70:30. Also preferred the polymers (3) do not contain units stemming from any other monomers than those according to formula (I) and formula (II), with the exception that units resulting from radical starter compounds or radical quencher compounds may be present. However, a part of units stemming from monomers according to

formula (II), preferably not more than 60 mol% referring to units from monomers according to formula (II), may be replaced by units stemming from the not quaternized monomer according to formula (IIa),



The synthesis of polymers (3) may start with monomer (IIa), and the copolymer resulting by its reaction with a monomer according to formula (I) is further reacted with a methylating agent. The weight average molecular weight ( $M_w$ ) of polymer (3) preferably is in the range of from 10 000 g/mol to 100 000 g/mol, imor preferred in the range of from 20 000 g/mol to 70 000 g/mol.

“ $M_w$ ” as used herein, relates to the weight average molecular weight of a polymer. It can be determined by any suitable means, preferably by gel permeation chromatography (GPC) against a suitable standard, such as a polystyrol standard, for example with THF as the eluent.

In various embodiments of the invention, the liquid detergent composition meets the requirement:  
 $0 < (d+e)/f < 10$ , preferably  $0.5 < (d+e)/f < 2.5$ , more preferably  $(d+e)/f$  is about 1.12.

Additionally or alternatively, the liquid detergent composition may meet the requirement:  
 $0 < ((d \cdot D) + (e \cdot E)) / (f \cdot F) < 3$ , preferably  $0.5 < ((d \cdot D) + (e \cdot E)) / (f \cdot F) < 1$ , more preferably  $((d \cdot D) + (e \cdot E)) / (f \cdot F)$  is about 0.75.

Additionally or alternatively, the liquid detergent composition may meet the requirement:  
 $0.4 < e/f < 2$ , preferably  $0.5 < e/f < 0.9$ , more preferably  $e/f$  is about 0.72.

Additionally or alternatively, the liquid detergent composition may meet the requirement:  
 $0 < (e \cdot E) / (f \cdot F) < 2$ , preferably  $0.2 < (e \cdot E) / (f \cdot F) < 0.6$ , more preferably  $(e \cdot E) / (f \cdot F)$  is about 0.45.

Additionally or alternatively, the liquid detergent composition may meet the requirement:  
 $-20 < (e \cdot f) / h < 0$ , preferably  $-5 < (e \cdot f) / h < -2$ , more preferably  $(e \cdot f) / h$  is about -2.95.

In preferred embodiments, the liquid detergent composition meets at least 2, more preferably at least 3, most preferably 4 or all 5 of the above requirements.

In various embodiments of the invention, the liquid detergent composition is a clear or translucent composition. “Clear”, as used herein, means that the composition is transparent and not cloudy or opaque and that there is no precipitation or phase separation. “Translucent”, as used herein, refers

to the property that the composition while not being fully transparent still allows the transmission of light and does not appear cloudy or opaque and that there is no precipitation or phase separation.

In various embodiments, the composition is a clear composition and meets the requirement:

$15 < -(a+b+c+d+e+g+h-1) < 25$ , preferably  $19 < -(a+b+c+d+e+g+h-1) < 22$ , more preferably  $-(a+b+c+d+e+g+h-1)$  is about 20.6.

Alternatively or additionally, when the composition is a clear composition it meets the requirement:

$-5 < -(a+(b \cdot B)+(c \cdot C)+(d \cdot D)+(e \cdot E)+(g \cdot B \cdot C)+(h \cdot E \cdot F)-1) < 5$ , preferably  $-1 <$

$-(a+(b \cdot B)+(c \cdot C)+(d \cdot D)+(e \cdot E)+(g \cdot B \cdot C)+(h \cdot E \cdot F)-1) < 1$ , more preferably

$-(a+(b \cdot B)+(c \cdot C)+(d \cdot D)+(e \cdot E)+(g \cdot B \cdot C)+(h \cdot E \cdot F)-1)$  is about -0.1; and/or

alternatively or additionally, when the composition is a clear composition it meets the requirement:

$12 < -(a+b+c+d+e+f+g-1) < 23$ , preferably  $16 < -(a+b+c+d+e+f+g-1) < 19$ , more preferably -

$(a+b+c+d+e+f+g-1)$  is about 17.6; and/or

alternatively or additionally, when the composition is a clear composition it meets the requirement:

$-4 < -(a+(b \cdot B)+(c \cdot C)+(d \cdot D)+(e \cdot E)+(f \cdot F)+(g \cdot B \cdot C)-1) < 0$ , preferably  $-3 <$

$-(a+(b \cdot B)+(c \cdot C)+(d \cdot D)+(e \cdot E)+(f \cdot F)+(g \cdot B \cdot C)-1) < -1$ , more preferably

$-(a+(b \cdot B)+(c \cdot C)+(d \cdot D)+(e \cdot E)+(f \cdot F)+(g \cdot B \cdot C)-1)$  is about -2.0; and/or

In preferred embodiments, the liquid detergent composition is transparent and meets at least 2, more preferably at least 3, most preferably all 4 of the above requirements.

In various embodiments, the composition is a translucent composition and meets the requirement:

$16 < -(a+b+c+d+e+g+h-1) < 26$ , preferably  $20 < -(a+b+c+d+e+g+h-1) < 23$ , more preferably -

$(a+b+c+d+e+g+h-1)$  is about 21.6; and/or

alternatively or additionally, when the composition is a translucent composition it meets the requirement:

$-4 < -(a+(b \cdot B)+(c \cdot C)+(d \cdot D)+(e \cdot E)+(g \cdot B \cdot C)+(h \cdot E \cdot F)-1) < 6$ , preferably  $0 <$

$-(a+(b \cdot B)+(c \cdot C)+(d \cdot D)+(e \cdot E)+(g \cdot B \cdot C)+(h \cdot E \cdot F)-1) < 2$ , more preferably

$-(a+(b \cdot B)+(c \cdot C)+(d \cdot D)+(e \cdot E)+(g \cdot B \cdot C)+(h \cdot E \cdot F)-1)$  is about 0.9; and/or

alternatively or additionally, when the composition is a translucent composition it meets the requirement:

$13 < -(a+b+c+d+e+f+g-1) < 24$ , preferably  $17 < -(a+b+c+d+e+f+g-1) < 20$ , more preferably -

$(a+b+c+d+e+f+g-1)$  is about 18.6; and/or

alternatively or additionally, when the composition is a translucent composition it meets the requirement:

$-3 < -(a+(b \cdot B)+(c \cdot C)+(d \cdot D)+(e \cdot E)+(f \cdot F)+(g \cdot B \cdot C)-1) < 1$ , preferably  $-2 <$

$-(a+(b \cdot B)+(c \cdot C)+(d \cdot D)+(e \cdot E)+(f \cdot F)+(g \cdot B \cdot C)-1) < 0$ , more preferably

$-(a+(b \cdot B)+(c \cdot C)+(d \cdot D)+(e \cdot E)+(f \cdot F)+(g \cdot B \cdot C)-1)$  is about -1.0.

In preferred embodiments, the liquid detergent composition is translucent and meets at least 2, more preferably at least 3, most preferably all 4 of the above requirements.

It has been found that compositions that meet the above requirements with the amount and ratio of the ingredients used show excellent stability while being aesthetically pleasing in that they are transparent or translucent formulations with little to no precipitation and/or phase separation even over extended periods of storage under varying temperature conditions.

The detergent compositions of the invention may further comprise a builder system. The builder system may be a phosphate-free builder system. However, the composition may comprise phosphonates. Accordingly, the term "phosphate-free", as used herein does not refer to phosphonates.

Suitable builders include, without limitation, inorganic builders, such as silicates, aluminosilicates (particularly zeolite), and carbonates, as well as organic builders, such as organic di- and polycarboxylic acids, aminocarboxylic acids, phosphonates, and combinations thereof. Preferred in the liquid compositions of the invention are water-soluble builders, in particular carbonates, di- and polycarboxylic acids, phosphonates and aminocarboxylic acids. Also suitable are alkali metal hydroxides, in particular sodium hydroxide, but these are, besides their optional use for pH control, not preferred.

"Water-soluble", as used herein, relates to a solubility in water at 20°C of at least 1 g/L, preferably at least 10 g /L.

Suitable inorganic builders include, without limitation, silicates, aluminosilicates (particularly zeolite), and carbonates, with water-soluble inorganic builders and in particular carbonates being preferred.

Suitable carbonates include alkali metal carbonates, hydrogen carbonates and sesquicarbonates, with alkali metal carbonates, in particular sodium carbonate being preferred.

In various embodiments, inorganic builders, in particular water-soluble inorganic builders, preferably carbonates, are used in amounts of up to 5 wt.%, relative to the total weight of the composition.

Suitable polycarboxylic acids, which can be used as free acids or in form of their salts, include, but are not limited to, citric acid, adipic acid, succinic acid, glutaric acid, malic acid, tartaric acid, maleic acid, fumaric acid, and sugar acids. In addition to their builder properties, the free acids can also be

used for pH control. Preferred are citric acid, succinic acid, glutaric acid, adipic acid and gluconic acid, and combinations thereof.

Particularly preferred are citric acid and their salts, i.e. citrates. In various embodiments, the polycarboxylic acids, in particular citric acid/citrate, are contained in the compositions of the invention in amounts of 0.5 to 10 wt.%, preferably 2 to 5 wt.%.

Suitable aminocarboxylic acids or salts thereof, i.e. aminocarboxylates, are selected from the group consisting of L-glutamic acid N,N-diacetic acid (GLDA), methyl glycine diacetic acid (MGDA), imino disuccinic acid (IDS), ethylenediamine N,N'-disuccinic acid (EDDS), diethylenetriamine pentaacetic acid (DTPA), beta-alanine N,N-diacetic acid, hydroxyethylenediamine triacetic acid (HEDTA), and salts, preferably alkali metal salts thereof as well as combinations of any one of more of the aforementioned. Particularly preferred is GLDA tetrasodium salt.

The aminocarboxylates are preferably used in amounts of 0.5 to 5 wt.%, preferably 1 to 4 wt.% relative to the total weight of the composition.

Suitable phosphonates include, without limitation, hydroxyalkane and/or aminoalkane phosphonates, including, for example, 1-hydroxyethane-1,1-diphosphonic acid (HEDP; etidronic acid), nitrilotri(methylphosphonic acid) (NTMP), 2-phosphonobutane-1,2,4-tricarboxylic acid (PBTC), ethylenediamine tetra(methylenephosphonic acid) (EDTMP), diethylenetriamine penta(methylenephosphonic acid) (DTPMP) as well as the higher homologs thereof and the salts thereof, in particular the sodium salts.

In various embodiments, the builder system is comprised of organic builders, such as citric acid/citrate, aminocarboxylic acids or salts thereof and/or phosphonic acids and salts thereof. The builder system may be comprised in the compositions in an amount of 2 to 25 wt.%, preferably 3 to 15 wt.%.

The pH value of the detergents according to the invention is generally in the range of from 7 to 12, preferably in the range from 7 to 10.5. High pH values, for example above 8, may be adjusted by the use of small quantities of monoethanolamine, sodium hydroxide or alkaline salts, such as sodium carbonate. The liquid detergents may be transparent (clear) or translucent and are flowable and may be poured under the sole effect of gravity without any need for other shear forces to be applied. Their viscosity is generally in the range of 500 to 10,000 mPas (Brookfield viscosimeter, spindle 3, 12 rpm, 20° C), preferably between 1,000 and 6,000 mPas.

In addition to the ingredients mentioned above, the detergents may commonly contain at least one, preferably two or more other substances selected from the group consisting of pH adjusting agents,

perfumes, fluorescing agents (optical brighteners), dyes, colorants, antimicrobial active substances, germicides, fungicides, antioxidants, softeners and preservatives.

Further possible ingredients include silicone oils, anti-redeposition agents, anti-greying agents, shrinkage preventers, wrinkle protection agents, dye transfer inhibitors, corrosion inhibitors, antistatic agents, bittering agents, ironing adjuvants, proofing and impregnation agents, swelling and anti-slip agents, complexing agents and UV absorbers.

Also included may be bleaching agents, bleach activators, bleach catalysts, and enzymes, however, in various embodiments, the compositions are free of those.

Especially for cold wash properties it can be beneficial to additionally include soap into the detergents. Accordingly, in some embodiments, the detergent compositions further comprise relative to their total weight 0.25 to 15 wt.%, preferably 0.5 to 12.5 wt.%, more preferably 1 to 10 wt.%, even more preferably 1.5 to 7.5 wt.% and most preferably 2 to 6 wt.% soap. Preferred are soaps from C<sub>12</sub>-C<sub>18</sub> fatty acids, i.e. the salts of lauric acid, myristic acid, palmitic acid, stearic acid, or mixtures derived from natural fatty acids, for example coconut, palm kernel, olive oil, or tallow fatty acids. Although the detergent compositions of the invention may contain soaps, said soaps are not included in the above described surfactant. This means that the indicated amount of soap is not to be included in the amounts of the non-soap surfactant as given above.

Further ingredients that are commonly used include colorants, perfumes and optical brighteners, as well as pH adjusting agents. All of these ingredients are well-known in the art and readily available.

The compositions disclosed herein may be provided in any suitable format. In various embodiments, the dosage of the detergent composition for one wash in a conventional EU washing machine ranges from 20 ml to 100 ml, preferably about 50 ml.

The present invention further relates to methods for cleaning textiles, wherein a washing liquor containing the liquid detergent composition of the present invention contacts the textile in at least one method step. The methods are preferably carried out in an automatic washing machine.

Methods for cleaning of textiles are generally characterized by the fact that in several different process steps various cleaning-active substances are applied to the textiles and after the contact time said cleaning-active substances are washed off, or that the textiles are treated in any other way with a detergent or a solution of said substance.

Also encompassed by the present invention is the use of the detergent compositions disclosed herein for cleaning/washing textiles, preferably in an automated washing machine.

All embodiments described herein in relation to the compositions of the invention are similarly applicable to the methods and uses of the invention and vice versa.

### Examples

The stability, X, of compositions P1 to P4 containing 1 wt.% boric acid, 3.2 wt.% citric acid, 1 wt.% diethylene triamine penta(methylene phosphonic acid), hepta sodium salt, 2.9 wt.% C<sub>12-18</sub> acid, sodium salt, 7.5 wt.% 2-ethanolamine, 3 wt.% perfume, 2 wt.% enzymes, and the ingredients given in table 1 in the amounts (in wt.% relative to the total weight of the composition; the part up to 100 wt.% was made up by water) also given there was measured by optical grading of two experimentalists by using a scale from 1 to 10 with 1, as given above in the description.

The surfactant block (ingredient A) consisted of 16 parts by weight of C<sub>12-14</sub> alcohol with 7 EO, 5.7 parts by weight of C<sub>12-14</sub> alkyl ether sulfate with 2 EO, sodium salt, 15.5 parts by weight of C<sub>10-13</sub> linear alkylbenzene sulfonic acid, sodium salt. B was propylene glycol, C Texcare® SRN 170, D Texcare® SRN 240, and E Sokalan® SR400 (copolymer of ((2-methacryloyloxy)ethyl)-trimethyl ammonium chloride). The stability of the compositions was assessed directly after preparation as well as after one week of storage at 20 °C (room temperature, rt), variable temperatures of from 24 °C to 40 °C (summer), variable temperatures of from 0 °C to 10 °C (winter) or variable temperatures of from 10 °C to 30 °C (autumn) conditions. The measured stability results of the compositions are given in table 2.

Table 1: Compositions

|    | A     | B     | C | D   | E    | water     |
|----|-------|-------|---|-----|------|-----------|
| P1 | 30    | 12.47 | 0 | 1.3 | 0    | up to 100 |
| P2 | 32.25 | 5     | 0 | 0   | 0    |           |
| P3 | 30    | 9.4   | 0 | 0   | 1    |           |
| P4 | 30    | 15    | 1 | 0   | 0.05 |           |

Table 2: Stability

|    | direct | rt | summer | autumn | winter |
|----|--------|----|--------|--------|--------|
| P1 | 1      | 1  | 3      | 1      | 1      |
| P2 | 1      | 1  | 1      | 1      | 1      |
| P3 | 2      | 2  | 1      | 2      | 1      |
| P4 | 1      | 1  | 1      | 1      | 1      |

## Claims

1. Liquid detergent composition comprising, relative to the total weight of the liquid detergent composition, 15 wt.% to 45 wt.%, preferably 32 wt.% to 35 wt.%, of non-soap surfactant; 0.5 wt.% to 50 wt.%, preferably 10 wt.% to 20 wt.%, of propylene glycol; 0.01 wt.% to 10 wt.%, preferably 0.9 wt.% to 2.5 wt.%, of at least one soil release polymer (SRP); and up to 84.49 wt.%, preferably 5 wt.% to 35 wt.%, more preferably 15 wt.% to 25 wt.%, water; wherein the weight ratio of non-soap anionic surfactant to nonionic surfactant is at least 1.2, preferably at least 1.25; and wherein the composition meets the requirement:

$$X = a + b \cdot B + c \cdot C + d \cdot D + e \cdot E + f \cdot F + g \cdot B \cdot C + h \cdot E \cdot F,$$

wherein

a is -25 to -20, preferably -23 to -22;

b is 0.6 to 0.8, preferably 0.73 to 0.79;

B is the concentration of surfactant in wt.% relative to the total weight of the composition;

c is 0.6 to 1.3, preferably 0.78 to 1.12;

C is the concentration of propylene glycol in wt.% relative to the total weight of the composition;

d is 0.6 to 1.2, preferably 0.74 to 1.0;

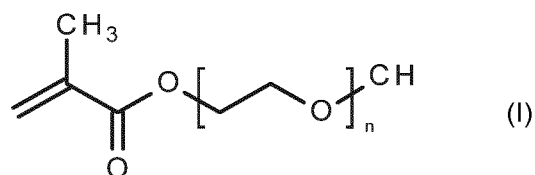
D is the concentration of a polyester type SRP based on terephthalic acid and ethylene and/or propylene glycol with a molecular weight  $M_w < 4000$  g/mol in wt.% relative to the total weight of the composition;

e is 0.8 to 7.0, preferably 1.1 to 5.5, more preferably 1.1 to 1.3;

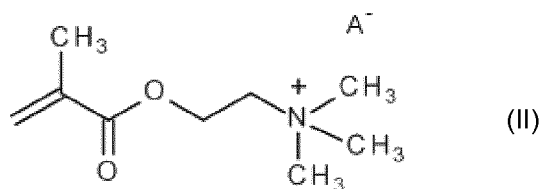
E is the concentration of a polyester type SRP based on terephthalic acid and ethylene and/or propylene glycol with a molecular weight  $M_w \geq 4000$  g/mol in wt.% relative to the total weight of the composition;

f is 1.2 to 2.3, preferably 1.6 to 1.9;

F is the concentration of a polymer, obtainable by radical copolymerisation of at least one monomer of formula (I),



in which n is a number equal to or larger than 3,  
with at least one monomer of formula (II),



in which  $A^-$  is an anion, in wt. % relative to the total weight of the composition;

$g$  is -0.1 to 0, preferably -0.04 to -0.01, more preferably -0.04 to -0.025, most preferably -0.04 to -0.03;

$h$  is -4 to 1, preferably -3 to 0, more preferably -1.5 to -1.0; and

$X$  is an indicator for the stability of the composition and is up to 3, preferably up to 2, and most preferably in the range of from 1 to 2;

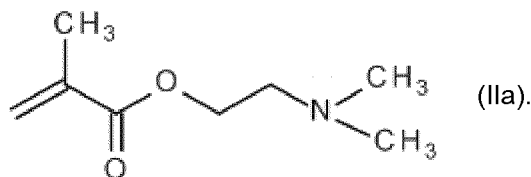
and wherein the composition meets the requirement

- (a)  $15 < -(a+b+c+d+e+g+h-1) < 25$ , preferably  $19 < -(a+b+c+d+e+g+h-1) < 22$ , more preferably  $-(a+b+c+d+e+g+h-1)$  is about 20.6; and/or
- (b)  $-5 < -(a+(b \cdot B)+(c \cdot C)+(d \cdot D)+(e \cdot E)+(g \cdot B \cdot C)+(h \cdot E \cdot F)-1) < 5$ , preferably  $-1 < -(a+(b \cdot B)+(c \cdot C)+(d \cdot D)+(e \cdot E)+(g \cdot B \cdot C)+(h \cdot E \cdot F)-1) < 1$ , more preferably  $-(a+(b \cdot B)+(c \cdot C)+(d \cdot D)+(e \cdot E)+(g \cdot B \cdot C)+(h \cdot E \cdot F)-1)$  is about -0.1; and/or
- (c)  $12 < -(a+b+c+d+e+f+g-1) < 23$ , preferably  $16 < -(a+b+c+d+e+f+g-1) < 19$ , more preferably  $-(a+b+c+d+e+f+g-1)$  is about 17.6; and/or
- (d)  $-4 < -(a+(b \cdot B)+(c \cdot C)+(d \cdot D)+(e \cdot E)+(f \cdot F)+(g \cdot B \cdot C)-1) < 0$ , preferably  $-3 < -(a+(b \cdot B)+(c \cdot C)+(d \cdot D)+(e \cdot E)+(f \cdot F)+(g \cdot B \cdot C)-1) < -1$ , more preferably  $-(a+(b \cdot B)+(c \cdot C)+(d \cdot D)+(e \cdot E)+(f \cdot F)+(g \cdot B \cdot C)-1)$  is about -2.0.

2. The detergent composition according to claim 1, wherein the detergent composition comprises at least one SRP that is selected from (1) polyester polymers based on terephthalic acid and propylene glycol with a molecular weight  $M_w$  of less than 4000 g/mol; (2) polyester polymers based on terephthalic acid and propylene glycol with a molecular weight  $M_w$  of equal to or more than 4000 g/mol; (3) polymers obtainable by radical copolymerisation of at least one monomer of formula (I) with at least one monomer of formula (II); and (4) combinations of (1) to (3).
3. The detergent composition according to claim 3, wherein
  - (1) the polyester polymers based on terephthalic acid and propylene glycol with a molecular weight  $M_w$  of less than 4000 g/mol are polyesters based on terephthalic acid and 1,2-propylene glycol endcapped with methoxy PEG 750 and a molecular weight  $M_w$  of about 2700 g/mol; and/or
  - (2) the polyester polymers based on terephthalic acid and propylene glycol with a molecular weight  $M_w$  of equal to or more than 4000 g/mol are polyesters based on terephthalic acid

and 1,2-propylene glycol endcapped with methoxy PEG 2000 and a molecular weight  $M_w$  of about 6200 g/mol; and or

- (3) a part of units stemming from monomers according to formula (II), preferably not more than 60 mol% referring to units from monomers according to formula (II), are replaced by units stemming from the not quaternized monomer according to formula (IIa),



4. The detergent composition according to any one of claims 1 to 3, wherein
  - (a) the composition is a translucent composition and meets the requirement:  
 $16 < -(a+b+c+d+e+g+h-1) < 26$ , preferably  $20 < -(a+b+c+d+e+g+h-1) < 23$ , more preferably  $-(a+b+c+d+e+g+h-1)$  is about 21.6; and/or
  - (b) the composition is a translucent composition and meets the requirement:  
 $-4 < -(a+(b \cdot B)+(c \cdot C)+(d \cdot D)+(e \cdot E)+(g \cdot B \cdot C)+(h \cdot E \cdot F)-1) < 6$ , preferably  $0 < -(a+(b \cdot B)+(c \cdot C)+(d \cdot D)+(e \cdot E)+(g \cdot B \cdot C)+(h \cdot E \cdot F)-1) < 2$ , more preferably  $-(a+(b \cdot B)+(c \cdot C)+(d \cdot D)+(e \cdot E)+(g \cdot B \cdot C)+(h \cdot E \cdot F)-1)$  is about 0.9; and/or
  - (c) the composition is a translucent composition and meets the requirement:  
 $13 < -(a+b+c+d+e+f+g-1) < 24$ , preferably  $17 < -(a+b+c+d+e+f+g-1) < 20$ , more preferably  $-(a+b+c+d+e+f+g-1)$  is about 18.6; and/or
  - (d) the composition is a translucent composition and meets the requirement:  
 $-3 < -(a+(b \cdot B)+(c \cdot C)+(d \cdot D)+(e \cdot E)+(f \cdot F)+(g \cdot B \cdot C)-1) < 1$ , preferably  $-2 < -(a+(b \cdot B)+(c \cdot C)+(d \cdot D)+(e \cdot E)+(f \cdot F)+(g \cdot B \cdot C)-1) < 0$ , more preferably  $-(a+(b \cdot B)+(c \cdot C)+(d \cdot D)+(e \cdot E)+(f \cdot F)+(g \cdot B \cdot C)-1)$  is about -1.0.
5. The detergent composition according to any one of claims 1 to 4, wherein the surfactant comprises at least one, preferably at least two anionic surfactants, preferably selected from alkyl ether sulfates, alkyl benzene sulfonate and combinations thereof, more preferably a combination thereof, and at least one nonionic surfactant, preferably an alkyl ether.
6. The detergent composition according to claim 5, wherein the surfactant comprises relative to the total weight of the composition:
  - (a) 3 to 8 wt.%, preferably 4.5 to 7 wt.% alkyl ether sulfates, preferably  $C_{10-16}$  alkyl ether sulfates with 1 to 7 EO, more preferably  $C_{12-14}$  fatty alcohol ether sulfates with 1-3 EO, most preferably lauryl ether sulfate with 2 EO;
  - (b) 10 to 20, preferably 11 to 17 wt.% of a linear alkyl benzene sulfonate, preferably dodecyl or tridecyl benzene sulfonate; and

- (c) 10 to 20, preferably 11 to 18 wt.% of an alkyl ether, preferably a C<sub>12-18</sub> alkyl ether with 1-12 EO, more preferably 7 EO.
7. The detergent composition according to any one of claims 1 to 6, further comprising a builder system, wherein the builder system comprises one or more water-soluble builders, preferably selected from the group consisting of di- and polycarboxylic acids, aminocarboxylic acids, phosphonates and combinations thereof.
  8. The detergent composition according to any one of claims 1 to 7, wherein the detergent composition further comprises at least one, preferably two or more other substances selected from the group consisting of soaps, pH adjusting agents, perfumes, fluorescing agents (optical brighteners), dyes, colorants, antimicrobial active substances, germicides, fungicides, antioxidants, softeners and preservatives.
  9. The detergent composition according to any one of claims 1 to 8, wherein n in the monomer according to formula (I) is a number in the range of from 3 to 120, more preferred a number in the range of from 5 to 50 und most preferred a number in the range of from 7 to 46, and in embodiments of the invention n is selected from the group encompassing the numbers 7, 23, and 46, and/or A<sup>-</sup> is selected from the group encompassing halides, such as fluoride, chloride, bromide, iodide, sulfate, hydrogensulfate, alkylsulfate, such as methylsulfate, and their mixtures;
  10. Method for cleaning textiles, wherein the textiles are contacted with a washing liquor containing the detergent composition according to any one of claims 1 to 9 in at least one step of a washing process.
  11. Use of a detergent composition according to any one of claims 1 to 9 for cleaning textiles.
  12. Method of producing a stable aqueous liquid detergent composition, comprising, relative to the total weight of the liquid detergent composition, 15 wt.% to 45 wt.%, preferably 32 wt.% to 35 wt.%, of non-soap surfactant; 0.5 wt.% to 50 wt.%, preferably 10 wt.% to 20 wt.%, of propylene glycol; 0.01 wt.% to 10 wt.%, preferably 0.9 wt.% to 2.5 wt.%, of at least one soil release polymer (SRP); and up to 84.49 wt.%, preferably 5 wt.% to 35 wt.%, more preferably 15 wt.% to 25 wt.%, water; wherein the weight ratio of non-soap anionic surfactant to nonionic surfactant is at least 1.2, preferably at least 1.25; by mixing the components in amounts that meet the requirement:

$$X = a + b \cdot B + c \cdot C + d \cdot D + e \cdot E + f \cdot F + g \cdot B \cdot C + h \cdot E \cdot F,$$

wherein

a is -25 to -20, preferably -23 to -22;

b is 0.6 to 0.8, preferably 0.73 to 0.79;

B is the concentration of surfactant in wt.% relative to the total weight of the composition;

c is 0.6 to 1.3, preferably 0.78 to 1.12;

C is the concentration of propylene glycol in wt.% relative to the total weight of the composition;

d is 0.6 to 1.2, preferably 0.74 to 1.0;

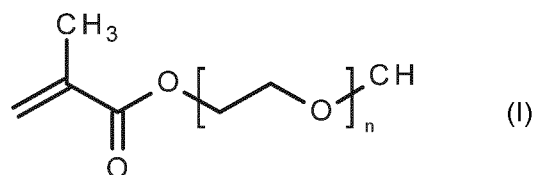
D is the concentration of a polyester type SRP based on terephthalic acid and ethylene and/or propylene glycol with a molecular weight  $M_w < 4000$  g/mol in wt.% relative to the total weight of the composition;

e is 0.8 to 7.0, preferably 1.1 to 5.5, more preferably 1.1 to 1.3;

E is the concentration of a polyester type SRP based on terephthalic acid and ethylene and/or propylene glycol with a molecular weight  $M_w \geq 4000$  g/mol in wt.% relative to the total weight of the composition;

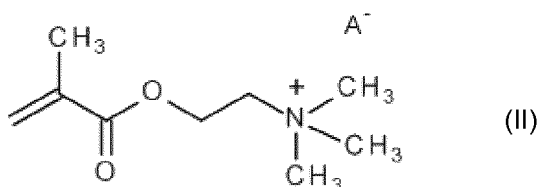
f is 1.2 to 2.3, preferably 1.6 to 1.9;

F is the concentration of a polymer, obtainable by radical copolymerisation of at least one monomer of formula (I),



in which n is a number equal to or larger than 3,

with at least one monomer of formula (II),



in which  $\text{A}^-$  is an anion, in wt.% relative to the total weight of the composition;

g is -0.1 to 0, preferably -0.04 to -0.01, more preferably -0.04 to -0.025, most preferably -0.04 to -0.03;

h is -4 to 1, preferably -3 to 0, more preferably -1.5 to -1.0; and

X is an indicator for the stability of the composition and is up to 3, preferably up to 2, and most preferably in the range of from 1 to 2;

and wherein the composition meets the requirement

(a)  $15 < -(a+b+c+d+e+g+h-1) < 25$ , preferably  $19 < -(a+b+c+d+e+g+h-1) < 22$ , more preferably  $-(a+b+c+d+e+g+h-1)$  is about 20.6; and/or

- (b)  $-5 < -(a+(b \cdot B)+(c \cdot C)+(d \cdot D)+(e \cdot E)+(g \cdot B \cdot C)+(h \cdot E \cdot F)-1) < 5$ , preferably  $-1 < -(a+(b \cdot B)+(c \cdot C)+(d \cdot D)+(e \cdot E)+(g \cdot B \cdot C)+(h \cdot E \cdot F)-1) < 1$ , more preferably  $-(a+(b \cdot B)+(c \cdot C)+(d \cdot D)+(e \cdot E)+(g \cdot B \cdot C)+(h \cdot E \cdot F)-1)$  is about  $-0.1$ ; and/or
- (c)  $12 < -(a+b+c+d+e+f+g-1) < 23$ , preferably  $16 < -(a+b+c+d+e+f+g-1) < 19$ , more preferably  $-(a+b+c+d+e+f+g-1)$  is about  $17.6$ ; and/or
- (d)  $-4 < -(a)+(b \cdot B)+(c \cdot C)+(d \cdot D)+(e \cdot E)+(f \cdot F)+(g \cdot B \cdot C)-1 < 0$ , preferably  $-3 < -(a+(b \cdot B)+(c \cdot C)+(d \cdot D)+(e \cdot E)+(f \cdot F)+(g \cdot B \cdot C)-1) < -1$ , more preferably  $-(a+(b \cdot B)+(c \cdot C)+(d \cdot D)+(e \cdot E)+(f \cdot F)+(g \cdot B \cdot C)-1)$  is about  $-2.0$ .

## INTERNATIONAL SEARCH REPORT

International application No  
PCT/EP2017/067849

## A. CLASSIFICATION OF SUBJECT MATTER

INV. C11D1/83 C11D3/00 C11D3/20 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)

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 2012/104159 A1 (UNILEVER PLC [GB];<br>UNILEVER NV [NL]; UNILEVER HINDUSTAN [IN];<br>CARSWELL) 9 August 2012 (2012-08-09)<br>page 4, lines 1-2<br>page 24, line 26 - page 29, line 29<br>page 44, lines 5-29<br>page 48; table 1<br>page 50, line 1 - page 51, line 6; table 2<br>page 55, line 11 - page 68; examples 4-17;<br>tables 3-10 | 1-8,<br>10-12         |
| X         | US 2013/123162 A1 (SOUTER PHILIP FRANK<br>[GB] ET AL) 16 May 2013 (2013-05-16)<br>page 48; examples 9-15<br>page 42, paragraph 0339 - page 43,<br>paragraph 0349<br>-----<br>-/--                                                                                                                                                             | 1-12                  |



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

"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

9 October 2017

Date of mailing of the international search report

17/10/2017

Name and mailing address of the ISA/

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## INTERNATIONAL SEARCH REPORT

International application No  
PCT/EP2017/067849

| C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT |                                                                                                                                                                                                                                                                                                           |                       |
|------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|
| Category*                                            | Citation of document, with indication, where appropriate, of the relevant passages                                                                                                                                                                                                                        | Relevant to claim No. |
| X                                                    | EP 2 535 401 A1 (DALLI WERKE GMBH & CO KG [DE]) 19 December 2012 (2012-12-19)<br>example 2; table 1<br>page 5, paragraph 0031<br>-----                                                                                                                                                                    | 1-8,<br>10-12         |
| X                                                    | WO 2016/032994 A1 (PROCTER & GAMBLE [US])<br>3 March 2016 (2016-03-03)<br>examples 1-3; tables 1-3<br>page 41, line 25 - page 42, line 21<br>-----                                                                                                                                                        | 1-12                  |
| A                                                    | WO 2015/078736 A1 (BASF SE [DE]; HENKEL AG & CO KGAA [DE]) 4 June 2015 (2015-06-04)<br>page 1, line 38 - page 4, line 7<br>page 5, lines 1-21<br>page 6, line 8 - page 7, line 1<br>page 9, lines 16-24<br>page 11, lines 20-26<br>page 12; example 1; table 1<br>page 15; table 2<br>claims 1-4<br>----- | 1-12                  |
| A                                                    | WO 2016/005271 A1 (UNILEVER PLC [GB]; UNILEVER NV [NL]; CONOPCO INC DBA UNILEVER [US]) 14 January 2016 (2016-01-14)<br>claim 1; example 3<br>-----                                                                                                                                                        | 1-12                  |

# INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2017/067849

| Patent document<br>cited in search report | Publication<br>date | Patent family<br>member(s)                                                                                                                          | Publication<br>date                                                                                          |
|-------------------------------------------|---------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------|
| WO 2012104159 A1                          | 09-08-2012          | AU 2012213597 A1<br>CN 103347928 A<br>EP 2670788 A1<br>ES 2538997 T3<br>WO 2012104159 A1<br>ZA 201305194 B                                          | 25-07-2013<br>09-10-2013<br>11-12-2013<br>25-06-2015<br>09-08-2012<br>25-09-2014                             |
| US 2013123162 A1                          | 16-05-2013          | NONE                                                                                                                                                |                                                                                                              |
| EP 2535401 A1                             | 19-12-2012          | EP 2535401 A1<br>ES 2622230 T3<br>PL 2535401 T3                                                                                                     | 19-12-2012<br>06-07-2017<br>31-07-2017                                                                       |
| WO 2016032994 A1                          | 03-03-2016          | CA 2956101 A1<br>EP 3186346 A1<br>JP 2017524786 A<br>US 2016060573 A1<br>WO 2016032994 A1                                                           | 03-03-2016<br>05-07-2017<br>31-08-2017<br>03-03-2016<br>03-03-2016                                           |
| WO 2015078736 A1                          | 04-06-2015          | AU 2014356698 A1<br>CA 2929146 A1<br>CN 105873965 A<br>EP 3074438 A1<br>JP 2016540075 A<br>KR 20160105790 A<br>US 2017174803 A1<br>WO 2015078736 A1 | 14-07-2016<br>04-06-2015<br>17-08-2016<br>05-10-2016<br>22-12-2016<br>07-09-2016<br>22-06-2017<br>04-06-2015 |
| WO 2016005271 A1                          | 14-01-2016          | CA 2953273 A1<br>CN 106471111 A<br>EP 3167033 A1<br>US 2017137755 A1<br>WO 2016005271 A1                                                            | 14-01-2016<br>01-03-2017<br>17-05-2017<br>18-05-2017<br>14-01-2016                                           |