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(54) LIQUID HAND DISHWASH FORMULATION COMPRISING HYDROXY FATTY ACID AND POLYMER

(57) The present invention is in the field of hard surface cleaning compositions, in particular liquid detergent compositions with improved emulsification and oily soil removal of hard surfaces, such as tableware. Accordingly, the the present invention relates to a liquid detergent composition comprising:
a. from 8 to 30 wt% of a surfactant system comprising:
i. a primary surfactant of the formula R_1-$(OR')_n$-O-SO_3^- M^+, wherein:
R_1 is saturated or unsaturated C_8-C_{16} alkyl chain;
R' is ethylene;
n is from 1 to 18;
M^+ is a suitable cation which provides charge neutrality selected from sodium, calcium, potassium and magnesium; and

ii. a secondary surfactant comprising an amphoteric surfactant;

b. from 0.001 to 0.2 wt% of polyethylene oxide having molecular weight higher than 200,000 g/mol;
c. from 0.05 to 2 wt% fatty acids comprising at least one saturated hydroxy fatty acid having 8 to 18 carbon atoms;
d. 0.1 to 5% by weight of an inorganic salt selected from the group consisting of sodium chloride, magnesium sulfate, sodium sulfate and combinations thereof; and
e. water.

The present invention further relates to a method of cleaning hard surfaces using the composition of the invention, as well as uses thereof.

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Description

FIELD OF THE INVENTION

[0001] The present invention is in the field of hard surface cleaning compositions, in particular liquid detergent compositions with improved emulsification and oily soil removal of hard surfaces, such as tableware.

BACKGROUND OF THE INVENTION

[0002] Household cleaning activities involve the use of a detergent product and water to rinse off the detergent product and finish the cleaning process. These activities are typically performed daily, often more than once a day, such as dish washing. That is, hard surface cleaning, dishwashing and other household cleaning activities are time consuming activities and, ideally, can be optimized when using products with excellent detergency and soil removal capacity.

[0003] Consumers normally associate cleaning efficiency with foam formation during the main wash step. Cleaning products with excellent foaming capacity are therefore of high commercial relevance. Although it is known that, technically, high foaming is not directed to soil removal capacity, a product with reduced foamability during the main wash is not appreciated by consumers, even if it has better detergents and improved soil removal capacity. It is thus desired to have a product that has both excellent emulsification and soil removal capacity, as well as good foamability in the main wash.

[0004] WO 2016/030226 relates to a liquid detergent composition having reduced foaming formation during rinse while maintaining foaming characteristics in the main wash. The examples describe compositions comprising: a surfactant system comprising sodium lauryl ether sulphate having 1 to 2 ethylene oxide units per molecule and linear alkyl benzene sulphonate, a non-ionic surfactant, fatty acids and water.

[0005] WO 2017/140472 describes dishwash compositions which form a foam during cleaning that is easily rinsed off. The compositions comprise an antifoaming system, the composition comprising a combination of fatty acids and non-ionic surfactants.

[0006] There remains a need for a hard surface cleaning composition with excellent oily soil removal without compromising consumer satisfaction in terms of foam formation in the main wash.

SUMMARY OF THE INVENTION

[0007] The inventors have developed a liquid detergent composition with improved foam formation during the main wash step ('flash foaming'). Advantageously, it has been observed that the compositions according to the invention have excellent emulsification properties and oily soil removal capacity. It has been found that a combination of a hydroxy fatty acid with polyethylene oxide of high molecular weight in a liquid detergent composition synergistically increases the emulsification capacity of the detergent composition.

[0008] Accordingly, in a first aspect, the invention relates to a liquid detergent composition comprising:

a. from 8 to 30 wt% of a surfactant system comprising:

i. a primary surfactant of the formula R_1-$(OR')_n$-O-$SO_3^-M^+$, wherein:

R_1 is saturated or unsaturated C_8-C_{16} alkyl chain;
R' is ethylene;
n is from 1 to 18;
M^+ is a suitable cation which provides charge neutrality selected from sodium, calcium, potassium and magnesium; and

ii. a secondary surfactant comprising an amphoteric surfactant;

b. from 0.001 to 0.2 wt% of polyethylene oxide having molecular weight higher than 200,000 g/mol;
c. from 0.05 to 2 wt% fatty acids comprising at least one saturated hydroxy fatty acid having 8 to 18 carbon atoms;
d. 0.1 to 5% by weight of an inorganic salt selected from the group consisting of sodium chloride, magnesium sulfate, sodium sulfate and combinations thereof; and
e. water.

[0009] In a second aspect, the invention relates to methods and uses related to the composition according to the invention.

DETAILED DESCRIPTION OF THE INVENTION

[0010] In one aspect, the present invention relates to a liquid detergent composition comprising:

a. from 8 to 30 wt% of a surfactant system comprising:

i. a primary surfactant of the formula R_1-$(OR')_n$-O-$SO_3^-M^+$, wherein:

R_1 is saturated or unsaturated C_8-C_{16} alkyl chain;
R' is ethylene;
n is from 1 to 18;
M^+ is a suitable cation which provides charge neutrality selected from sodium, calcium, potassium and magnesium; and

ii. a secondary surfactant comprising an amphoteric surfactant;

b. from 0.001 to 0.2 wt% of polyethylene oxide having molecular weight higher than 200,000 g/mol;
c. from 0.05 to 2 wt% fatty acids comprising at least one saturated hydroxy fatty acid having 8 to 18 carbon atoms;
d. 0.1 to 5% by weight of an inorganic salt selected from the group consisting of sodium chloride, magnesium sulfate, sodium sulfate and combinations thereof; and
e. water.

Surfactant System

[0011] The liquid detergent composition of the present invention comprises a surfactant system. The surfactant system comprises at least one primary and at least one secondary surfactant. The surfactant system may comprise further primary and secondary surfactants, as well as other surfactants that are not anionic.
[0012] The surfactant system is present in the composition in a concentration of 8 to 30%, preferably not less than 15%, more preferably not less than 18%, still more preferably not less than 20% but typically not more than 28%, preferably not more than 27% or even not more than 26% by weight of the composition.

Primary surfactant

[0013] The primary surfactant of the present invention is a surfactant of the formula:

$$R_1\text{-}(OR')_n\text{-}O\text{-}SO_3^-M^+,$$

wherein:

R_1 is saturated or unsaturated C_8-C_{16}, preferably C_{12}-C_{14} alkyl chain; preferably, R_1 is a saturated C_8-C_{16}, more preferably a saturated C_{12}-C_{14} alkyl chain;

R' is ethylene;

n is from 1 to 18; preferably from 1 to 15, more preferably from 1 to 10 ,still more preferably from 1 to 5.

M^+ is a suitable cation which provides charge neutrality, preferably sodium, calcium, potassium, or magnesium, more preferably a sodium cation.

[0014] Preferably, the primary surfactant is sodium lauryl ether sulphate having 1 to 3 ethylene oxide units per molecule, more preferably, sodium lauryl ether sulphate having 1 to 2 ethylene oxide units per molecule.
[0015] Primary surfactant may be present in a concentration of 5 to 95 %, preferably at least 10 %, more preferably at least 12%, still more preferably at least 20% but typically not more than 85%, preferably not more than 75%, more preferably not more than 65%, still more preferably not more than 55% by weight of the surfactant system.

Secondary surfactant

[0016] The secondary surfactant of the present invention comprises an amphoteric surfactant.

[0017] Amphoteric surfactants suitable for use in the invention include alkyl amine oxides, alkyl betaines, alkyl amidopropyl betaines, alkyl sulphobetaines (sultaines), alkyl glycinates, alkyl carboxyglycinates, alkyl amphopropionates, alkylamphoglycinates alkyl amidopropyl hydroxysultaines, acyl taurates and acyl glutamates, wherein the alkyl and acyl groups have from 8 to 19 carbon atoms. Examples include lauryl amine oxide, cocodimethyl sulphopropyl betaine and preferably lauryl betaine, cocamidopropyl betaine and sodium cocamphopropionate
The amphoteric surfactant is selected from cocoamidopropyl betaine (CAPB), coco amido propyl amine oxide (CAPAO), cocodiethanol amide (CDEA) and cocomonoethanol amide (CMEA), or mixtures thereof. More preferably, the amphoteric surfactant is cocoamidopropyl betaine.

[0018] The amphoteric surfactant is present in a concentration of 0.1 to 100%, preferably at least 5%, more preferably at least 10%, still more preferably at least 50% or even more preferably at least 75% but typically not more than 90%, preferably not more than 85%, more preferably not more than 80% by weight of the secondary surfactant.

[0019] The secondary surfactant may be present in a concentration of 5 to 95 %, preferably at least 12%, more preferably at least 20%, still more preferably at least 30% but typically not more than 85%, preferably not more than 75%, more preferably not more than 65%, still more preferably not more than 55% by weight of the surfactant system.

[0020] Preferably, the ratio of amphoteric surfactant to the primary surfactant 1:10 to 1:3, preferably 1:8 to 1:5.

Other surfactants

[0021] The surfactant system of the present invention may further comprise other surfactants common in the art, such as anionic, cationic, non-ionic, zwitterionic or amphoteric surfactants, and/or mixtures thereof. The other surfactants may include alkyl polyglycoside and/or rhamnolipids

[0022] Suitable non-ionic surfactants include the condensation products of a higher alcohol (e.g., an alkanol containing about 8 to 18 carbon atoms in a straight or branched chain configuration) condensed with about 5 to 30 moles of ethylene oxide, for example, lauryl or myristyl alcohol condensed with about 16 moles of ethylene oxide (EO), tridecanol condensed with about 6 moles of EO, myristyl alcohol condensed with about 10 moles of EO per mole of myristyl alcohol, the condensation product of EO with a cut of coconut fatty alcohol containing a mixture of fatty alcohols with alkyl chains varying from 10 to about 14 carbon atoms in length and wherein the condensate contains either about 6 moles of EO per mole of total alcohol or about 9 moles of EO per mole of alcohol and tallow alcohol ethoxylates containing 6 EO to 11 EO per mole of alcohol. Particularly preferred is Lauryl alcohol condensed with 5, 7 and 9 moles of ethylene oxide (Laureth 5, Laureth 7 and Laureth 9).

[0023] Accordingly, in a preferred embodiment, the surfactant system includes a non-ionic surfactant selected from Laureth 5, Laureth 7 and Laureth 9, or mixtures thereof.

[0024] Condensates of 2 to 30 moles of ethylene oxide with sorbitan mono- and tri-C10-C20 alkanoic acid esters having a HLB of 8 to 15 also may be employed as the nonionic surfactant. These surfactants are well known and are available from Imperial Chemical Industries under the Tween trade name. Suitable surfactants include polyoxyethylene (4) sorbitan monolaurate, polyoxyethylene (4) sorbitan monostearate, polyoxyethylene (20) sorbitan trioleate and polyoxyethylene (20) sorbitan tristearate.

[0025] When present, the non-ionic surfactant is in a concentration of 0.1 to 5 % by weight, preferably at least 0.3%, still more preferably at least 0.5% but preferably not more than 4%, more preferably not more than 3%, even more preferably not more than 2% by weight of the surfactant system.

[0026] The surfactant system may comprise a surfactant selected from alkylbenzene sulphonates and derivatives; and alkyl sulphates.

[0027] Alkylbenzene sulphonates and derivatives include water-soluble alkali metal salts of organic sulphonates having alkyl radicals typically containing from about 8 to about 22 carbon atoms, preferably 8 to 18 carbon atoms, still more preferably 12 to 15 carbon atoms and may be unsaturated. Examples include sodium salt of linear alkylbenzene sulphonate, alkyl toluene sulphonate, alkyl xylene sulphonate, alkyl phenol sulphonate, alkyl naphthalene-sulphonate, ammonium diamylnaphthalene-sulphonate and sodium dinonylnaphthalene-sulphonate and mixtures with olefin sulphonates.

[0028] Examples of alkyl sulphates include sodium lauryl sulphate, ammonium lauryl sulphate, diethanolamine (DEA) lauryl sulphate. Suitable examples also includes alkyl sulphates commercially available from natural source with trade names Galaxy 689, Galaxy 780, Galaxy 789, Galaxy 799 SP and from synthetic origin with trade names Safol 23, Dobanol 23A or 23S, Lial 123 S, Alfol 1412S, Empicol LC3, Empicol 075SR.

[0029] Preferably, the secondary surfactant is selected from sodium salt of alkylbenzene sulphonate and sodium lauryl sulphate, and/or linear or branched derivatives thereof. More preferably, the secondary surfactant is sodium salt of linear alkylbenzene sulphonate.

Polyethylene oxide

[0030] The liquid detergent composition of the present invention comprises polyethylene oxide having a molecular weight higher than 200,000 g/mol. The polyethylene oxide may be present as a single compound or a mixture of at least two polyethylene oxides having a molecular weight higher than 200,000 g/mol.

[0031] As used herein, 'polyethylene oxide' refers to polyethylene oxides (PEO) or high molecular weight polyethylene glycols (PEGs). As used herein, 'high molecular weight polyethylene glycol' means a linear homopolymer derived from ethylene oxide and having a molecular weight of at least 200,000 g/mol.

[0032] Preferably, the polyethylene oxide has a molecular weight of 300,000 g/mol to 4,000,000 g/mol, more preferably 500,000 g/mol to 3,000,000 g/mol, even more preferably 1,000,000 to 2,000,000 g/mol.

[0033] Suitable examples include, but are not limited to, polyethylene oxides commercially available with trade names WSR N-10, WSR N-80, WSR N-750, WSR 205, WSR 1105, WSR N-12K, WSR N-60K, WSR-301, WSR-303, WSR-308, all from The Dow Chemical Company; polyethylene oxide (PEO) from MSE, Beantown chemicals or Acros Organics; PEO 100K from Polysciences; PEO-1, PEO2, PEO-3, PEO-4, PEO-8, PEO15, PEO-18, PEO-57, PEO-29 from Sumitomo Seika Chemicals Ltd.; or ALKOX polyethylene Glycol from Meisei Chemical Works.

[0034] The polyethylene oxide is present in an amount of 0.001 to 0.2 wt.% based on the total weight of the composition. Preferably, the polyethylene oxide is present in an amount of 0.01 to 0.18, more preferably 0.1 to 0.15 wt.%.

Fatty Acids

[0035] The liquid detergent composition of the present invention comprises 0.05 to 2 wt% of fatty acids comprising at least one of saturated hydroxy fatty acids having 8 to 18 carbon atoms.

[0036] Fatty acids used in the present invention are saturated fatty acids. Preferably, the saturated hydroxy fatty acid is 12-hydroxy stearic acid.

[0037] Preferably, the fatty acids are present in an amount of 0.1 to 1.8 wt.% based on total weight of the detergent composition. More preferably, the fatty acids are present in an amount of at least 0.4 % by weight, preferably at least 0.6 % but typically not more than 1.5 %, more preferably not more than 1.3 %, most preferably not more than 1.0 % by weight of the composition.

[0038] The compositions of the invention may further comprise non-hydroxy saturated fatty acids, preferably selected from lauric acid (C_{12}), stearic acid (C_{18}), palmitic acid (C_{16}) or combinations thereof.

[0039] In a preferred embodiment, the saturated hydroxy fatty acid represents at least 50 wt.% of the total fatty acids present in the composition, more preferably at least 75 wt.%, even more preferably at least 85 wt.% of the total fatty acids present in the composition.

[0040] In one preferred embodiment, the weight ratio of polyethylene oxide to fatty acids is in the range from 1:10 to 1:100, preferably in the range from 1:20 to 1:50.

Inorganic salts

[0041] The liquid detergent composition comprises 0.1 to 5% by weight of an inorganic salt selected from the group consisting of sodium chloride, magnesium sulfate, sodium sulfate and combinations thereof. Inorganic salts advantageously control the viscosity of the detergent compositions.

[0042] Preferably, liquid detergent composition comprises 0.5 to 4%, more preferably 1.0 to 3%, even more preferably 1.5 to 2.5 % by weight of an inorganic salt.

Water

[0043] The composition further comprises water. Preferably 60 to 92%, more preferably not less than 62%, still more preferably not less than 65% but typically not more than 85%, more preferably not more than 80%, still more preferably not more than 75% by weight of the composition.

Optional Ingredients

[0044] The composition according to the invention may contain other ingredients which aid in the cleaning or sensory performance. Compositions according to the invention can also contain, in addition to the ingredients already mentioned, various other optional ingredients such as thickeners, colorants, preservatives, polymers, anti-microbial agents, perfumes, pH adjusters, sequestrants, alkalinity agents and hydrotropes.

pH of the composition

[0045] pH of the composition of the present invention is between 4.0 to 8.0. Preferably, the pH is 4.5 and 7.5, preferably between 4.5 and 7.0, more preferably between 5.5 and 6.5.

Product format

[0046] The composition may be used neat or diluted. For hard surface cleaning or for dishwashing purposes, the composition is typically applied neat directly to the surface. When applied in a diluted form, the composition is preferably diluted with water in a ratio of between 1:1 to 1:10

[0047] Both manual dishwashing and machine dishwashing are considered in the context of the present invention.

[0048] The composition may be packaged in the form of any commercially available bottle for storing the liquid.

[0049] The bottle containing the liquid can be of different sizes and shapes to accommodate different volumes of the liquid; preferably between 0.25 and 2 L, more preferably between 0.25 and 1.5 L or even between 0.25 and 1 L. The bottle is preferably provided with a dispenser, which enables the consumer an easier mode of dispersion of the liquid. Spray or pump-dispensers may also be used.

Process

[0050] In a second aspect, the invention relates to a method of cleaning a hard surface comprising the steps of:

a. contacting the hard surface, optionally in diluted form, with the liquid detergent composition according to the present invention, and
b. removing the detergent composition from the hard surface, optionally by rinsing with water.

[0051] The method can be performed manually (e.g. cleaning by hand) or in a cleaning device, such as an industrial or at home dishwashing machines. Preferably, the method of cleaning is a manual cleaning, more preferably hand dishwashing.

[0052] 'Hard surface', as used herein, typically means utensils or kitchenware, kitchen worktops, kitchen floors, sinks and kitchen counter tops, floors and bathrooms.

[0053] In a further aspect, the invention relates to the use of a liquid detergent composition of the invention for hand-washing hard surfaces, preferably dishware.

[0054] In any of the processes above, the composition of the invention is applied onto a hard surface in neat or diluted form. The composition may be applied by any known ways such as by using a cleaning implement, such as scrub, sponge paper, cloth, wipes or any other direct or indirect application. The applied composition may be cleaned using a cleaning implement such as a scrub, sponge, paper, cloth or wipes with or without water, or rinsed off with water, optionally running water.

[0055] The invention will now be illustrated by means of the following non-limiting examples.

EXAMPLES

[0056] A dish wash composition (termed BC1) was prepared. The pH of the formulation was around pH 6.

Table 1: Formulations of Base Composition

Ingredient	BC1
Sodium Lauryl ether sulphate 1EO (on 100% active basis)	8.94
Coco Amido Propyl Betaine (On 100% active basis)	1.56
Laureth 7	0.5
Water	To 100

[0057] For the purpose of experiments, varying levels of fatty acids and polyethylene oxide were added to BC1. Details are shown in Table 2. All the formulations were subjected to emulsification tests.

Example 1: Emulsification capacity

[0058] Base composition 1 was tested with and without fatty acids ('FA') and polyethylene oxides ('Polyox') (amounts given in weight % based on total composition), as described in Table 2 below. The compositions were evaluated as to their emulsification capacity. 8.08 g of the compositions were poured into a 250 ml beaker, to which 50 ml of 10 F.H. ('French hardness') water at 25°C were added followed by stirring until dissolution. To the homogeneous mixture, 44.56 g of coloured sunflower oil (1.0 l of oil coloured with 0.045 g of Red dye) were added. The mixture was stirred for 2 min at 1200 RPM, and transferred to a 250 ml glass cylinder.

[0059] The non-emulsified phase was measured (in mm) after 30 min from start time (1st reading) and after 90 min from start time (2nd reading). 'E value' ("emulsification value") was according to the following equation:

$$E\ value = [(1^{st}\ Reading + 2^{nd}\ Reading) * 60]/2$$

[0060] The results of 'E value' are in table 2 below.

Table 2 - Varying amounts of FA and polyox in BC1

	No FA[2]	**+0.4 wt.% FA**
No polyox[1]	174	177
+ 0.02 wt.% polyox	120	93
[1]Polyox: PEG 45-M. Mw: 2,000,000 g/mol (DOW, Sigma) [2]FA: 12-hydroxy stearic acid (Vertellus).		

[0061] The lower the 'E value' the better the emulsification and oily soil removal. The results show better emulsification in compositions comprising combinations of polyethylene oxide of high molecular weight with fatty acids at varying amounts as compared to compositions comprising only one of the components.

Claims

1. A liquid detergent composition comprising:

a. from 8 to 30 wt% of a surfactant system comprising:

i. a primary surfactant of the formula R_1-$(OR')_n$-O-$SO_3^-M^+$, wherein:

R_1 is saturated or unsaturated C_8-C_{16} alkyl chain;
R' is ethylene;
n is from 1 to 18;
M^+ is a suitable cation which provides charge neutrality selected from sodium, calcium, potassium and magnesium; and

ii. a secondary surfactant comprising an amphoteric surfactant;

b. from 0.001 to 0.2 wt% of polyethylene oxide having molecular weight higher than 200,000 g/mol;
c. from 0.05 to 2 wt% fatty acids comprising at least one saturated hydroxy fatty acid having 8 to 18 carbon atoms;
d. 0.1 to 5% by weight of an inorganic salt selected from the group consisting of sodium chloride, magnesium sulfate, sodium sulfate and combinations thereof; and
e. water.

2. The composition according to claim 1, wherein the primary surfactant is sodium lauryl ether sulphate having 1 to 2 ethylene oxide units per molecule.

3. The composition according to claim 1 or 2, wherein the amphoteric surfactant selected from cocoamidopropyl betaine, coco amido propyl amine oxide, cocodiethanol amide and cocomonoethanol amide, preferably coco ami-

dopropyl betaine.

4. The composition according to any one of previous claims, wherein the weight ratio of the primary surfactant to the secondary surfactant is in the range of from 10:1 to 3:1.

5. The composition according to any one of previous claims, wherein the polyethylene oxide has a molecular weight of 500,000 g/mol to 3,000,000 g/mol.

6. The composition according to claim 5, wherein the polyethylene oxide has a molecular weight of 1,000,000 g/mol to 3,000,000 g/mol.

7. The composition according to any one of previous claims, wherein the at least one saturated hydroxy fatty acid is 12-hydroxy stearic acid.

8. The composition according to any one of previous claims, wherein the ratio of polyethylene oxide to fatty acids is in the range from 1:10 to 1:100, preferably in the range from 1:20 to 1:50.

9. The composition according to any one of previous claims, wherein the surfactant system further comprises a nonionic surfactant, preferably selected from Laureth 5, Laureth 7, Laureth 9 and mixtures thereof.

10. The composition according to claim 9, wherein the non-ionic surfactant is present in an amount of 0.1 to 5 wt.% based on total weight of the surfactant system.

11. The composition according to any one of previous claims, wherein the pH of the composition is in the range from 4 to 8.

12. A method of cleaning a hard surface comprising the steps:

    a. contacting the hard surface, optionally in diluted form, with the liquid detergent composition according to anyone of claims 1 to 11, and
    b. removing the detergent composition from the hard surface, optionally by rinsing with water.

13. The method of cleaning according to claim 11, wherein the hard surface is dishware.

14. The method of cleaning according to claims 11 or 13, wherein cleaning is dishwashing, preferably hand dishwashing.

15. Use of a liquid detergent composition according to any one of claims 1 to 11 for handwashing hard surfaces, preferably dishware.

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EUROPEAN SEARCH REPORT

Application Number
EP 18 21 3089

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	22 May 2019	Vernier, Frédéric

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 18 21 3089

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