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(54) Title: PRESERVED CLEANING COMPOSITIONS

(57) Abstract: The present invention relates to liquid detergent compositions comprising a preservation system comprising a short chain (C1 to C6), unsaturated, organic acid or salt thereof having at least two carboxyl groups, a surfactant system and an inorganic salt. The invention also relates to a method of preparing such a composition and the use of such a composition.



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PRESERVED CLEANING COMPOSITIONS

Field of the Invention

- 5 The present invention relates to the area of preservation chemicals for liquid detergent compositions, in particular to liquid detergent compositions for cleaning hard surfaces.

Background

- 10 In the liquid detergent industry, there is a constant need for preservation chemicals, especially preservation chemicals that are from natural sources, that are abundant and readily available.

A large number of antimicrobial active compounds are already employed in the
15 cleaning compositions, but alternatives are continually sought after. Not all antimicrobial agents have adequate preservation properties and thus the need for new preservation chemicals is particularly required. It is noted that substances used in the domestic cleaning compositions for domestic use must be:

- Toxicologically acceptable
- 20 - Readily tolerated by the skin in case of skin contact via e.g. splashes
- Stable
- Largely and preferably completely odourless
- inexpensive to prepare (i.e. employing standard processes and/or starting from standard precursors)
- 25 - easy to formulate (i.e. preferably liquid) and should not be detrimental to the final product.

The present application has found a preservation chemical suitable for use with
cleaning compositions, in particular to hard surface cleaning compositions.

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Description of the Invention

The present invention relates to a liquid detergent composition comprising, by weight of the total composition,

- 35 a) 0.1 to 5% by weight of a preservation system comprising a short chain (C1 to C6), unsaturated, organic acid or salt thereof having at least two carboxyl

- groups, wherein the short chain unsaturated organic acid is itaconic acid or salt thereof;
- b) 5 to 30% by weight of a surfactant system comprising:
- (i) a primary surfactant of the formula $R1-(OR')_n-O-SO_3^- M^+$, wherein:
- 5 R1 is saturated or unsaturated C8-C18 alkyl chain;
R' is ethylene;
n is from 0 to 18;
M⁺ is a suitable cation which provides charge neutrality selected from sodium, calcium, potassium and magnesium; and
- 10 (ii) a secondary surfactant selected from the group consisting of anionic surfactant, non-ionic surfactants, amphoteric surfactants and mixtures thereof;
- c) 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
- 15 d) water.

The invention further relates to a method of preserving a composition as defined herein by the use of; a short chain (C1 to C6), unsaturated, organic acid or salt thereof having at least two carboxyl groups.

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Detailed description of the invention

Preservation system

- 25 Preferably, the total level of short chain (C1 to C6), unsaturated, organic acid or salt thereof, in particular itaconic acid in the total composition is from 0.05 to 7 wt.% of the total composition, more preferably 0.1 to 5 wt.% most preferably from 0.2 to 3 wt.%. Preferably, the composition comprises at least 0.5% by weight of itaconic acid.

- 30 Preferably, the pH of the composition is in the range of 2 to 12, more preferably in the range of 2 to 11, even more preferably in the range of 3 to 10, most preferably in the range 3 to 7.

Surfactant System

- 35 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 is present in the composition in a concentration of 5 to 30 wt.%, preferably 8 to 25 wt.%, even more preferably 10 to 22 wt.% by weight of the composition. The surfactant system is preferably not less than 15 wt.%, more preferably not less than 18 wt.%, still more preferably not less than 20 wt.% but typically not more than 30 wt.%, preferably not more than 28% or even not more than 26% by weight of the composition.

Primary surfactant

The primary surfactant of the present invention is a surfactant of the formula:

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$R_1-(OR')_n-O-SO_3^- M^+$, wherein:

- R_1 is saturated or unsaturated C_8-C_{18} , preferably $C_{10}-C_{16}$ alkyl chain more preferably $C_{12}-C_{14}$ alkyl chain. Preferably, R_1 is a saturated C_8-C_{18} , more preferably a saturated $C_{10}-C_{16}$ alkyl chain, more preferably a saturated $C_{12}-C_{14}$ alkyl chain. The saturated or unsaturated alkyl chain may be a linear or a branched alkyl chain.
- R' is ethylene;
- n is from 0 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 or magnesium cation, even more preferably a sodium cation.

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Preferably, the composition comprises a primary surfactant of the formula $R^1-(OR')_n-O-SO_3^- M^+$, wherein R^1 is saturated $C_{10}-C_{14}$ alkyl chain; R' is ethylene; and n is from 1 to 4.

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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.

35 Preferably, $n=0$. In such cases, the primary surfactant is an alkyl sulphate. Examples of alkyl sulphates include sodium lauryl sulphate, ammonium lauryl sulphate,

diethanolamine (DEA) lauryl sulphate. Suitable examples also include 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.

- 5 Preferably, the secondary surfactant is selected from sodium salt of linear alkylbenzene sulphonate and sodium lauryl sulphate. More preferably, the secondary surfactant is sodium salt of linear alkylbenzene sulphonate.

- 10 The primary surfactant may be present in a concentration of 5 to 95 wt.%, preferably at least 10 wt.%, more preferably at least 12 wt.%, still more preferably at least 20 wt.% but typically not more than 85 wt.%, preferably not more than 75 wt.%, more preferably not more than 65 wt.%, still more preferably not more than 55 wt.% by weight of the surfactant system.

15 Secondary surfactant

The secondary surfactant of the present invention is selected from anionic, non-ionic and amphoteric surfactants.

- 20 The anionic surfactant is preferably an alkylbenzene sulphonate or derivatives thereof, methyl ester sulphonate or mixtures thereof. 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.

- 25 Examples include sodium salt of linear alkylbenzene sulphonate, alkyl toluene sulphonate, alkyl xylene sulphonate, alkyl phenol sulphonate, alkyl naphthalene-sulphonate, ammonium diaminonaphthalene-sulphonate and sodium dinonylnaphthalene-sulphonate and mixtures with olefin sulphonates.

- 30 Methyl ester sulfonates (MES) are anionic surfactants with the general structure $[R^2CHCO_2R^3]_nSO_3M^{m+}$. MES surfactants useful herein include sulfonated fatty acid alkyl esters of the formula: wherein R^2 is, on the average, a C6 to C22 alkyl, R^3 is on the average a C1 to C8 alkyl, M is an alkali metal or alkaline earth metal cation, or a mixture thereof, and n is 1 when M is an alkali metal cation and m is 2, when M is an
35 alkaline earth metal cation.

The hydrophobic portion of these sulfonated alkyl esters have the sulfonate group at the α -position, i.e., the sulfonate group is positioned at the carbon atom adjacent the carbonyl group. The alkyl portion of the hydrophobic portion, which corresponds to the R^2 portion of the sulfonated fatty acid alkyl esters, is on the average a C6 to C22 alkyl.

- 5 Preferably, the alkyl portion of this hydrophobic portion, R^2 , is on the average a non-branched C8 to C16 hydrocarbon particularly when R^3 is methyl. R^3 , forming the ester portion of the sulfonated alkyl esters, is on the average a C1 to C8 alkyl. Preferably, R^3 is on the average a C1 to C6 alkyl, and most preferably a C1 alkyl, i.e., methyl.
- 10 Preferably the distribution is such that R^2 is, on the average, a C14 to C16 alkyl (approximately, for example, a 95% C14, 5% C16 mixture) and R^3 is methyl. More preferably, the distribution is such that R is, on the average, a C12 to C16 alkyl (approximately, for example, a 3% C12, 28% C14, 69% C 16 mixture) and R^3 is methyl. The distribution is such that R^2 preferably is, on the average, a C10 to C16 alkyl
- 15 (approximately, for example, a 60% C10, 35% C12, 5% C14 mixture) and R^3 is methyl.

The cationic portion, M , is an alkali metal or alkaline earth metal cation or mixture thereof. Preferably, M is chosen from sodium, potassium, lithium, magnesium, calcium, and mixtures thereof. Most preferably, M is sodium or a mixture containing sodium.

- 20 When M is an alkali metal cation (valence=1) m is 1 and when M is an alkaline earth metal cation (valence=2) m is 2.

- Preferably, the secondary surfactant a salt of linear alkylbenzene sulphonate and/or a methyl ester sulfonate. More preferably, the secondary surfactant is sodium salt of
- 25 linear alkylbenzene sulphonate.

- The secondary surfactant is preferably an amphoteric surfactant. Amphoteric surfactants suitable for use in the invention include alkyl amine oxides, alkyl betaines, alkyl amidopropyl betaines, alkyl sulphobetaines (sultaines), alkyl glycines, alkyl
- 30 carboxyglycines, alkyl amphopropionates, alkylamphoglycines 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 preferably 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.

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When present, the amphoteric surfactant is in a concentration of 0.1 to 20%, preferably at least 0.5%, more preferably at least 3%, still more preferably at least 6% or even more preferably at least 8% but typically not more than 18%, preferably not more than 16%, more preferably not more than 13%, still more preferably not more than 10% by weight of the surfactant system.

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The secondary surfactant may be a non-ionic surfactant. The non-ionic surfactant is preferably selected from the group consisting of primary alcohol ethoxylates, secondary alcohol ethoxylates, alkylphenol ethoxylates, alkylpolyoxyethers, alkylaminoalkoxylates, ethylene-oxide-propylene oxide condensates on primary alkanols, tertiary amino oxides and alkylpolyglycosyls.

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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, 6, 7, 8 and 9 moles of ethylene oxide (Laureth 5, Laureth 6, Laureth 7, Laureth 8 and Laureth 9).

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The surfactant system preferably includes a non-ionic surfactant selected from Laureth 5, Laureth 7 and Laureth 9, or mixtures thereof.

Condensates of 2 to 30 moles of ethylene oxide with sorbitan mono- and tri-C10-C20 alkanolic 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

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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.

- 5 The non-ionic surfactant is preferably an alkylpolyglycosyl containing a C₆₋₂₂ fatty alcohol residue, more preferably a C₈₋₁₈ fatty alcohol residue, wherein the glycosyl residue of the alkylpolyglycoside preferably comprises a linear oligo- or polysaccharide.

Alkyl mono- and polyglycoside surfactants have the general formula: R'O(R'')_n wherein
10 R' is a monovalent organic radical containing from about one to about 30 carbon atoms. Preferably, monovalent saturated aliphatic, unsaturated aliphatic or aromatic radicals include are selected from the group consisting of alkyl, hydroxyalkyl, alkenyl, hydroxyalkenyl, aryl, alkylaryl, hydroxyalkylaryl, arylalkyl, alkenylaryl, arylalkenyl, and mixtures thereof. More preferably, R' represents monovalent, saturated aliphatic
15 groups which contain from 8 to about 16 carbon atoms. R'' represents a moiety derived from a reducing saccharide containing 5 or 6 carbon atoms. The "n" represents the number of reducing saccharide moieties, or degree of polymerization, and has a value of from 1 (monoglycoside) to about 20. Preferably, n averages from 1 to about 5. The term "alkyl polyglycosides" as used herein refers to both alkyl monoglycosides and as
20 alkyl polyglycosides.

The alkyl polyglycoside can be formed using reducing saccharides such as arabinose, xylose, glucose, galactose and the like. Glycosidation by the Fischer process is the oldest known process for making alkyl glycosides by reacting saccharides with alcohols
25 in the presence of strong acids. Other processes have been developed including base-catalyzed alkylation and enzymatically catalyzed syntheses of alkyl glucosides. Preferably, the raw material is sugar-derived (glucose and sucrose) and the resulting surfactant is an alkyl polyglucoside. Such surfactants have a hydrophobic fatty alcohol portion and a hydrophilic glucoside portion. Alkyl polyglycoside and alkyl polyglucoside
30 are available commercially from, for example, Cognis, Akzo Nobel, and Uniqema.

Preferably, the non-ionic surfactant comprises polyglycosides having alkyl chain length of 8 carbon atoms and a second polyglycoside having alkyl chain length of 14 carbon atoms. More preferably, the nonionic surfactant comprises a mixture of polyglycosides
35 having alkyl chain lengths of from about 8 carbon atoms up to about 14 carbon atoms. Commercially available polyglycoside surfactant products are often mixtures of

“naturally derived” surfactants already having a mixed range of alkyl chain lengths. Typically, the nonionic surfactant comprises a combination of a short chain alkyl polyglycoside surfactant having alkyl chain lengths of from about 8 to about 10 carbon atoms, and a longer chain alkyl polyglycoside surfactant having alkyl chain lengths up to 14 or 16 carbon atoms.

Preferably, the alkyl polyglycoside is an a C₈-C₁₆ fatty alcohol glucoside. Such an alkyl polyglucoside is cocoglucoside, is available under the tradename PLANTACARE 818 UP (Cognis), having a C₈-C₁₆ alkyl portion. Alternatively, the alkyl polyglucoside is preferably a capryl glucoside, such is available under the tradename PLANTACARE 810 UP (Cognis), having a C₈-C₁₆ alkyl portion. The alkyl polyglucoside is preferably a lauryl glucoside, such is available under the tradename PLANTACARE 1200 UP (Cognis), having a C₈-C₁₆ alkyl portion. Yet another alkyl polyglucoside is preferably decyl glucoside, such is available under the tradename PLANTACARE 2000 UP (Cognis), having a C₈-C₁₆ alkyl portion.

Preferably, secondary surfactant comprises a rhamnolipid. Rhamnolipids are a class of glycolipid. They are constructed of rhamnose combined with beta- hydroxy fatty acids. Rhamnose is a sugar. Fatty acids are ubiquitous in animals and plants. The carboxyl end of the fatty acid end is connected to the rhamnose. Rhamnolipids are compounds of only three common elements; carbon, hydrogen, and oxygen. They are a crystalline acid.

Rhamnolipids may be produced by strains of the bacteria *Pseudomonas aeruginosa*. There are two major groups of rhamnolipids; mono-rhamnolipids and di-rhamnolipids.

Mono-rhamnolipids have a single rhamnose sugar ring. A typical mono-rhamnolipid produced by *P. aeruginosa* is L-rhamnosyl- -hydroxydecanoyl- -hydroxydecanoate (RhaC₁₀C₁₀). It may be referred to as Rha-C₁₀-C₁₀, with a formula of C₂₆H₄₈O₉. Mono-rhamnolipids have a single rhamnose sugar ring. The IUPAC Name is 3-[3-[(2R,3R,4R,5R,6S)-3,4,5-trihydroxy-6-methyloxan- 2-yl]oxydecanoyloxy]decanoic acid.

Di-rhamnolipids have two rhamnose sugar rings. A typical di-rhamnolipid is L-rhamnosyl-L- rhamnosyl- -hydroxydecanoyl- -hydroxydecanoate (Rha₂C₁₀C₁₀). It may be referred to as Rha- Rha-C-₁₀-C-₁₀, with a formula of C₃₂H₅₈O₁₃. The IUPAC name is

3-[3-[4,5-dihydroxy-6-methyl-3-(3,4,5-trihydroxy-6-methyloxan-2-yl)oxyoxan-2-yl]oxydecanoyloxy]decanoic acid.

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.

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.

The ratio of primary surfactant to the secondary surfactant is in the range from 1:4 to 4:1, more preferably 1:3 to 3:1, even more preferably 1:2 to 2:1, most preferably 1:1.

Other surfactants

The surfactant system of the present invention may further comprise other surfactants common in the art, such as cationic or zwitterionic surfactants, and/or mixtures thereof.

Inorganic salts

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.

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.

Preferably, the inorganic salt is sodium chloride, sodium sulfate, magnesium sulfate, or mixtures thereof, more preferably the inorganic salt is sodium chloride. Typically, mixtures of inorganic salts preferably comprise sodium sulfate and magnesium sulfate.

Water

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

5 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, sequesterants, alkalinity agents and hydrotropes.

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The composition preferably comprises 0.1 to 1.0 % by weight fatty acids being saturated non-hydroxy C8-12 fatty acid and a saturated non-hydroxy C14-18 fatty acid, where ratio of amount of said C8-12 fatty acid to that of said C14-18 fatty acid is from 1:0.1 to 1:10 parts by weight.

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Fatty acids that may be used in the present invention are saturated or unsaturated fatty acids. Preferably, the fatty acid is selected from the group consisting of caprylic acid, lauric acid, myristic acid, palmitic acid, stearic acid, oleic acid, 12-hydroxy stearic acid and combinations thereof. More preferably, the fatty acid is selected from lauric acid (C₁₂), stearic acid (C₁₈), palmitic acid (C₁₆) or combinations thereof. Preferably, stearic acid (C₁₈) and palmitic acid (C₁₆) are present in a weight ratio of 40:60 to 60:40, preferably 45:55 to 55:45, even more preferably 50:50.

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Preferably, the preservation system further comprises an additional preservation chemical selected from: aromatic alcohol, benzoic acid or a salt thereof, terpineol, geraniol, perillyl alcohol, menthol, terpinene, linalool, citronellol and mixtures thereof thereof.

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The aromatic alcohol is preferably selected from group consisting of ethylvanillin, eugenol, thymol, P-hydroxybenzaldehyde, 4n butyl phenol, P-hydroxyacetophenone, vanillin, salicylic acid or salt thereof, o-cymen-5-ol, carvacrol and mixtures thereof

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Additional polymers may be present in the composition as defined herein, for example a polymer selected from the group consisting of microfibrillated celluloses, polyacrylates, poly(ethylene oxide), polysaccharides, polysaccharide derivatives and mixtures thereof. Preferably, the polymer is poly(ethylene oxide). Typically, polymers

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are present in a range of 0.01 to 0.2 wt.%, more preferably 0.02 to 0.1, even more preferably 0.04 to 0.075 wt.%.

pH of the composition

- 5 pH of the composition of the present invention is between 3.0 to 8.0. Preferably, the pH is 4.0 and 7.5, preferably between 4.5 and 7.0, more preferably between 5.5 and 6.5.

Product format

- 10 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 of dishware. When applied in a diluted form, the composition is preferably diluted with water in a ratio of between 1:1 to 1:10. The dishware may be dipped into the diluted form, removed and wiped clean. Alternatively, the dishware may be submerged in the diluted form, washed and then removed from the diluted form.

- 15 Both manual dishwashing and machine dishwashing are considered in the context of the present invention.

- 20 The composition may be packaged in the form of any commercially available bottle for storing the liquid.

- 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
25 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

- 30 In a second aspect, the invention relates to a method of preserving a liquid detergent composition by combining a short chain (C1 to C6), unsaturated, organic acid or salt thereof having at least two carboxyl groups, wherein the short chain unsaturated organic acid is itaconic acid or salt thereof, with anionic surfactants and an inorganic salt.

- 35 'Hard surface', as used herein, typically means utensils or kitchenware, kitchen tops, kitchen floors, sinks and platforms, floors and bathrooms.

In a further aspect, the invention relates to a method of hand washing dishes using the liquid detergent composition as defined here above, wherein the method comprises the steps of:

- contacting the dishes with the liquid detergent composition; and
- 5 - rinsing the dishes with water.

In yet another aspect, the invention relates to a method of cleaning a hard surface comprising the steps:

- a. applying on to a hard surface, optionally in diluted form, a composition as
- 10 defined herein;
- b. cleaning the hard surface; and
- c. rinsing the hard surface with water.

In any of the processes above, the composition of the invention is applied onto a hard

15 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.

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

Examples

25 Liquid detergent compositions were prepared having the base formulation according to Table 1:

Table 1

Ingredient	Percentage ingredient
Water	balance
SLES	9
LAS	9
Organic acid + pH adjustment	0.5
Polyethylene glycol (DOW)	0.05
Sodium chloride	1

Citric acid, lactic acid and itaconic acid were added used as organic acid respectively in amounts of 0.5% (w/w).

Sample preparation

Itaconic acid, lactic acid and citric acid were purchased from Sigma-Aldrich. Six samples of unpreserved conditioner were dosed with 0.5% (w/w) itaconic acid, citric acid and lactic acid separately. An unpreserved sample was kept as a control. Each dosed product was adjusted to pH 5 using 50% sodium hydroxide (Sigma-Aldrich).

Challenge test method

A modified challenge test method was performed on a subsample of both the unpreserved and each dosed product. The bacterial challenge test microorganisms are summarised in Table 3 with an inoculum level of 4.77×10^7 CFU/G introduced into each sample. The microbial challenge pools were added to each sample container at a ratio of 1:10 microorganism to product. Each inoculated product sample was mixed with a sterile spatula to ensure a homogenous distribution of the inocula throughout the product.

Table 2: Microbial Challenge test pool and Inoculum levels

Microorganism	Pool Inoculum CFU/mL	In-product inoculum CFU/G
<i>Pseudomonas aeruginosa</i>	4.77×10^8	4.77×10^7
<i>Burkholderia cepacia</i>		
<i>Pseudomonas putida</i>		

Both the inoculum level and the level of microorganism within each sample was quantified using a Total Viable Count (TVC) pour plate method after contact times as indicated in data tables. A 1:10 dilution was made with a subsample of each product, performed separately in Peptone (0.1%)/ tween 80 (2%) neutralising agent. A 1:10 and 1:100 dilution of each subsample was performed and pour plates produced at each dilution using tryptone soya agar. Plates were incubated at 28°C for 48 hours and then examined for growth. Visible colonies were counted with the aid of a Quebec Colony Counter and recorded for analysis against the challenge test criteria.

Table 3: Microbial challenge test against *Pseudomonas aeruginosa*, *Burkholderia cepacia* and *Pseudomonas putida* log kill

Sample	Organic acid	Log reduction				
		24 hours	48 hours	5 hours	7 days	14 days
1	None	<2.68	3.16	2.66	3.12	<2.68
2	Itaconic acid	>6.68	>6.68	>6.68	>6.68	>6.68
3	Lactic acid	<2.68	<2.68	<2.68	3.15	2.76
4	Citric acid	3.15	3.36	3.18	3.43	4.10

Claims

1. A liquid detergent composition comprising, by weight of the total composition,
 - a) 0.1 to 5% by weight of a preservation system comprising a short chain (C_1 to C_6), unsaturated, organic acid or salt thereof having at least two carboxyl groups, wherein the short chain unsaturated organic acid is itaconic acid or salt thereof;
 - b) 5 to 30% by weight 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_{18} alkyl chain;
 R' is ethylene;
 n is from 0 to 18;
 M^+ is a suitable cation which provides charge neutrality selected from sodium, calcium, potassium and magnesium; and
 - (ii) a secondary surfactant selected from the group consisting of anionic, non-ionic, amphoteric surfactants and mixtures thereof;
 - c) 0.1 to 10% by weight of an inorganic salt selected from the group consisting of sodium chloride, magnesium sulfate, sodium sulfate and combinations thereof; and
 - d) water.
2. The composition according to any of the preceding claims, comprising at least 0.5% by weight of itaconic acid.
3. The composition according to any one of the preceding claims, wherein the amphoteric surfactant, preferably the amphoteric surfactant is an alkyl amido propyl betaines, alkyl amphotoacetate or amphodiacetate.
4. The composition according to any one of the preceding claims, wherein the secondary surfactant is a salt of linear alkylbenzene sulphonate.
5. The composition according to any of the preceding claims, wherein the non-ionic surfactant, is a polyoxyether of lauryl alcohol.

6. The composition according to any of the preceding claims, comprising 0.1 to 1.0 % by weight fatty acids being saturated non-hydroxy C₈₋₁₂ fatty acid and a saturated non-hydroxy C₁₄₋₁₈ fatty acid, where ratio of amount of said C₈₋₁₂ fatty acid to that of said C₁₄₋₁₈ fatty acid is from 1:0.1 to 1:10 parts by weight.
7. The composition according to any of the preceding claims, wherein the preservative system comprises an additional preservation chemical selected from: aromatic alcohol, benzoic acid or a salt thereof, terpineol, geraniol, perillyl alcohol, menthol, terpinene, linalool, citronellol and mixtures thereof.
8. The composition according to any of the preceding claims, wherein the pH is in the range of 3 to 8, preferably, the pH is 4.0 and 7.5, more preferably between 4.5 and 7.0, even more preferably between 5.5 and 6.5.
9. The composition according to any of the preceding claims, comprising 60-90% by weight of water.
10. The composition according to any of the preceding claims, comprising a primary surfactant of the formula R₁-(OR')_n-O-SO₃⁻ M⁺, wherein
R₁ is saturated C₁₀-C₁₄ alkyl chain;
R' is ethylene; and
n is from 1 to 4.
11. The composition according to any of the preceding claims, comprising a polymer selected from the group consisting of microfibrillated celluloses, polyacrylates, polysaccharides, polysaccharide derivatives and mixtures thereof.
12. The composition according to any of the preceding claims, wherein the weight ratio between primary and secondary surfactants is 1:4 to 2:1.
13. A method of manually cleaning dishware comprising the step of contacting a composition according to claims 1-12 to said dishware.
14. A method of preserving a liquid detergent composition by combining

a short chain (C_1 to C_6), unsaturated, organic acid or salt thereof having at least two carboxyl groups, wherein the short chain unsaturated organic acid is itaconic acid or salt thereof, with anionic surfactants and an inorganic salt.

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2019/081382

A. CLASSIFICATION OF SUBJECT MATTER

INV. C11D1/37 C11D1/83 C11D3/04 C11D3/20
ADD. C11D1/14 C11D1/29

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 2011/092325 A2 (ECOLIFE B V [NL]; DEVELTER DIRK WILLEM GODFRIED [BE] ET AL.) 4 August 2011 (2011-08-04) claims 1, 5 and 11; examples 5-F1, 6-Rim8, 7-trial 2 page 27, line 22 - page 32, line 7 -----	1-14
X	US 5 580 849 A (DYET JULIE A [GB] ET AL) 3 December 1996 (1996-12-03) examples I-IV column 1, line 5 - line 24 column 3, line 54 - column 4, line 9 column 10, line 47 - column 11, line 37 -----	1-14
A	CN 107 937 150 A (WEIPU SECURITY TECH XUZHOU CO LTD) 20 April 2018 (2018-04-20) example 1 paragraphs [0003] - [0006], [0018] - [0027] -----	1-14



Further documents are listed in the continuation of Box C.



See patent family annex.

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"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

14 January 2020

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2019/081382

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US 5580849 A	03-12-1996	NONE	

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