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(54) Title: COMPOSITION

(57) Abstract: A laundry detergent composition comprising methyl ester ethoxylate surfactant (MEE) and an alkyl ether sulphate (AES), a proportion of which comprises C18 and a domestic method of treating a textile, the method comprising the step of treating a textile with an aqueous solution of 0.5 to 20 g/L of the detergent composition, and optionally drying the textile.



## COMPOSITION

The present invention relates to improved laundry detergent compositions.

5

US 6 156 717 (Erilli) discloses a light duty liquid detergent with desirable cleansing properties and mildness to the human skin comprising: a C8-18 ethoxylated alkyl ether sulfate anionic surfactant, a sulfonate anionic surfactant, a water insoluble organic compound, a cosurfactant, an ethoxylated methyl ester and water.

10

Despite the prior art there remains a need for improved laundry liquid compositions.

Accordingly, and in a first aspect there is provided a laundry detergent composition comprising methyl ester ethoxylate surfactant (MEE) and an alkyl ether sulphate (AES), a proportion of which AES comprises C18, wherein the MEE comprises at least 10% wt. of the total MEE, MEE with C18.

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We have surprisingly found that combining MEE with an AES which includes C18 AES provides improved formulation options.

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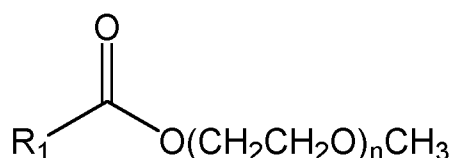
The laundry composition may be liquid, liquid unit dose, gel, most preferably an aqueous liquid.

The format may be a regular laundry liquid to be applied to a washing machine or as a hand washing detergent, a concentrated product, a liquid unit dosed product, a product for an auto-dosing system, a dilutable product, i.e. a product which is to be diluted by the consumer to form a regular laundry liquid composition, and such like.

25

### Methyl Ester Ethoxylate (MEE)

30 Methyl Ester Ethoxylate surfactants are of the form:



Where  $R_1\text{COO}$  is a fatty acid moiety, such as lauric, myristic, oleic, stearic, palmitic. Fatty acid nomenclature is to describe the fatty acid by 2 numbers A:B where A is the number of carbons in the fatty acid and B is the number of double bonds it contains. For example oleic is 18:1, stearic is 18:0 and palmitic 16:0. The position of the double bond on the chain may be given in brackets, 18:1(9) for oleic, 18:2 (9,12) for linoleic where 9 is the number of carbons from the COOH end.

The integer n is the mole average number of ethoxylates

10 Methyl Ester Ethoxylates (MEE) are described in chapter 8 of Biobased Surfactants (Second Edition) Synthesis, Properties, and Applications Pages 287-301 (AOCS press 2019) by G.A. Smith; J.Am.Oil. Chem.Soc. vol 74 (1997) page 847-859 by Cox M.E. and Weerasooriva U; Tenside Surf.Det. vol 28 (2001) page by 72-80 by Hreczuch et al; by C. Kolano. Household and Personal Care Today (2012) page 52-55; J.Am.Oil. Chem.Soc. 15 vol 72 (1995) page 781-784 by A.Hama *et al.* MEE may be produced the reaction of methyl ester with ethylene oxide, using catalysts based on calcium or magnesium. The catalyst may be removed or left in the MEE.

20 An alternative route to preparation is transesterification reaction of a methyl ester or esterification reaction of a carboxylic acid with a polyethylene glycol that is methyl terminated at one end of the chain.

The methyl ester may be produced by transesterification reaction of methanol with a triglyceride, or esterification reaction of methanol with a fatty acid. Transesterification reactions of a triglyceride to fatty acid methyl esters and glycerol are discussed in Fattah et al (Front. Energy Res., June 2020, volume 8 article 101) and references therein. Common catalysts for these reactions include sodium hydroxide, potassium hydroxide, and sodium methoxide. Esterase and lipases enzyme may also be used. Triglycerides occur naturally in plant fats or oils, preferred sources are rapeseed oil, castor oil, maize 25 oil, cottonseed oil, olive oil, palm oil, safflower oil, sesame oil, soybean oil, high steric/high oleic sunflower oil, high oleic sunflower oil, non-edible vegetable oils, tall oil and any mixture thereof and any derivative thereof. The oil from trees is called tall oil. Used food cooking oils may be utilised. Triglycerides may also be obtained from algae, fungi, yeast or bacteria. Plant sources are preferred.

Distillation and fractionation process may be used in the production of the methyl ester or carboxylic acid to produce the desired carbon chain distribution. Preferred sources of triglyceride are those which contain less than 35%wt polyunsaturated fatty acids in the oil before distillation, fractionation, or hydrogenation.

5

Fatty acid and methyl ester may be obtained from Oleochemical suppliers such as Wilmar, KLK Oleo, Unilever oleochemical Indonesia. Biodiesel is methyl ester and these sources may be used.

10 The methyl ester ethoxylate preferably has a mole average of from 5 to 25 ethoxylate groups (EO), more preferably from 7 to 13. The most preferred ethoxylate comprises 9 to 11EO, even more preferably 10EO.

The MEE preferably comprises at least 10% wt., more preferably at least 40 wt%. of the  
15 total MEE, MEE with C18 chains.

Preferably, the MEE comprises monounsaturated C18 and wherein the weight proportion of monounsaturated C18 to other C18 components (i.e. not including C18:1) is at least 2.2, more preferably at least 2.5. Preferably, the weight proportion of monounsaturated  
20 C18 to other C18 components is from 2.2 to 10. More preferably the weight proportion of monounsaturated C18 to other C18 components is from 2.9 to 7.0.

Preferably, at least 5% wt., more preferably at least 10% wt. of the total C18:1 MEE in the composition has from 9 to 11EO, even more preferably exactly 10EO.

25

In the context of the wider MEE contribution, it is preferred that at least 40wt% of the total MEE in the composition is C18:1.

Preferably less than 10wt% of the total MEE in the composition has a carbon chain length  
30 lower than 16 or greater than 18.

In addition, it is preferred that the MEE component also comprises some C16 MEE. Accordingly, it is preferred that the total MEE component comprises from 5 to 50% wt.

total MEE, C16 MEE. Preferably the C16 MEE is greater than 90wt%, more preferably greater than 95wt% C16:0.

5 Further, it is preferred that the total MEE component comprises less than 15% wt, more preferably less than 10wt%, most preferably less than 5wt% total MEE of polyunsaturated C18, i.e. C18:2 and C18:3. Preferably C18:3 is present at less than 1 wt%, more preferably less than 0.5wt%, most preferably essentially absent. The levels of polyunsaturation may be controlled by distillation, fractionation or partial hydrogenation of the raw materials (triglyceride or methyl ester) or of the MEE.

10

Further, it is preferred that the C18:0 component is less than 10wt% by weight of the total MEE present.

15

Further, it is preferred that the components with carbon chains of 15 or shorter comprise less than 4wt% by weight of the total MEE present.

20

Preferred sources for the alkyl groups for the MEE include methyl ester derived from distilled palm oil and distilled high oleic methyl ester derived from palm kernel oil, partially hydrogenated methyl ester of low eruc rapeseed oil, methyl ester of high oleic sunflower oil, methyl ester of high oleic safflower oil and methyl ester of high oleic soybean oil.

25

High Oleic oils are available from DuPont (Plenish high oleic soybean oil), Monsanto (Visitiva Gold Soybean oil), Dow (Omega-9 Canola oil, Omega-9 sunflower oil), the National Sunflower Association and Oilseeds International.

30

Preferably the double bonds in the MEE are greater than 80wt%, more preferably greater than 95% in the cis configuration. Preferably the 18:1 component is oleic. Preferably the 18:2 component is linoleic.

The methyl group of the methyl ester may be replaced by an ethyl or propyl group. Methyl is most preferred.

Preferably, the composition has a pH of 5 to 10, more preferably 6 to 8, most preferably 6.1 to 7.0.

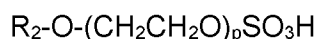
Preferably, the methyl ester ethoxylate comprises from 0.1 to 50% wt. of the composition methyl ester ethoxylate. More preferably the composition comprises from 2 to 40% MEE and most preferably from 4 to 30% wt. MEE.

- 5 Preferably, the composition comprises at least 50% wt. water but this depends on the level of total surfactant and is adjusted accordingly.

### **C18 Alcohol ether sulfates**

The composition comprises C18 ether sulfate of the formula:

10



- Where  $R_2$  is comprises C18 alkyl chains together with optional C16. More preferably  $R_2$  is selected from saturated, monounsaturated and polyunsaturated linear C16 and C18 alkyl chains and where  $p$  is from 3 to 20, preferably 4 to 12, more preferably 5 to 10. The mono-unsaturation is preferably in the 9 position of the chain, where the carbons are counted from the ethoxylate bound chain end. The double bond may be in a cis or trans configuration (oleyl or elaidyl), but is preferably cis. The cis or trans ether sulfate  $CH_3(CH_2)_7-CH=CH-(CH_2)_8O-(CH_2CH_2O)_nSO_3H$ , is described as C18:1( $\Delta$ 9) ether sulfate.
- 20 This follows the nomenclature CX:Y( $\Delta$ Z) where  $X$  is the number of carbons in the chain,  $Y$  is the number of double bonds and  $\Delta Z$  the position of the double bond on the chain where the carbons are counted from the OH bound chain end.

- Preferably,  $R_2$  is selected from saturated C16, saturated C18 and monounsaturated C18.
- 25 More preferably, the saturated C16 is at least 90% wt. of the C16 content linear alkyl. As regards the C18 content, it is preferred that the predominant C18 moiety is C18:1, more preferably C18:1( $\Delta$ 9). Preferably, the proportion of C18 constitutes at least 50% wt. of the total C16 and C18 alkyl ether sulphate surfactant. More Preferably, the proportion of monounsaturated C18 constitutes at least 50% wt. of the total C16 and C18 alkyl ether sulphate surfactant.
- 30

More preferably, the proportion of monounsaturated C18 constitutes at least 60% wt., most preferably at least 75 of the total C16 and C18 alkyl ether sulphate surfactant.

Preferably, the C16 alcohol ethoxylate surfactant comprises at least 2% wt. and more preferably, from 4% of the total C16 and C18 alkyl ether sulphate surfactant.

5 Preferably, the saturated C18 alkyl ether sulphate surfactant comprises up to 20% wt. and more preferably, up to 11% of the total C16 and C18 alkyl ether sulphate surfactant. Preferably the saturated C18 content is at least 2% wt. of the total C16 and C18 alkyl ether sulphate content.

10 Where the composition comprises a mixture of the C16/18 sourced material for the alkyl ether sulphate as well as the more traditional C12 alkyl chain length materials it is preferred that the total C16/18 alkyl ether sulphate content should comprise at least 10% wt. of the total alkyl ether sulphate, more preferably at least 50%, even more preferably at least 70%, especially preferably at least 90% and most preferably at least 95% of alkyl ether sulphate in the composition.

15 Ether sulfates are discussed in the Anionic Surfactants: Organic Chemistry edited by Helmut W. Stache (Marcel Dekker 1995), Surfactant Science Series published by CRC press.

20 Linear saturated or mono-unsaturated C20 and C22 ether sulfate may also be present. Preferably the weight fraction of sum of 'C18 ether sulfate' / 'C20 and C22 ether sulfate' is greater than 10.

25 Preferably the C16 and C18 ether sulfate contains less than 15 wt.%, more preferably less than 8 wt.%, most preferably less than 4wt% and most preferably less than 2% wt. of the ether sulfate polyunsaturated ether sulfate. A polyunsaturated ether sulfate contains a hydrocarbon chains with two or more double bonds.

30 Ether sulfate may be synthesised by the sulphonation of the corresponding alcohol ethoxylate. The alcohol ethoxylate may be produced by ethoxylation of an alkyl alcohol. The alkyl alcohol used to produce the alcohol ethoxylate may be produced by transesterification of the triglyceride to a methyl ester, followed by distillation and hydrogenation to the alcohol. The process is discussed in Journal of the American Oil Chemists' Society. 61 (2): 343–348 by Kreutzer, U. R. Preferred alkyl alcohol for the

reaction is oleyl alcohol with an iodine value of 60 to 80, preferably 70 to 75, such alcohol are available from BASF, Cognis, Ecogreen.

5 The degree of polyunsaturation in the surfactant may be controlled by hydrogenation of the triglyceride as described in: A Practical Guide to Vegetable Oil Processing (Gupta M.K. Academic Press 2017). Distillation and other purification techniques may be used.

Ethoxylation reactions are described in Non-Ionic Surfactant Organic Chemistry (N. M. van Os ed), Surfactant Science Series Volume 72, CRC Press.

10

Preferably the ethoxylation reactions are base catalysed using NaOH, KOH, or NaOCH<sub>3</sub>. Even more preferred are catalyst which provide narrower ethoxy distribution than NaOH, KOH, or NaOCH<sub>3</sub>. Preferably these narrower distribution catalysts involve a Group II base such as Ba dodecanoate; Group II metal alkoxides; Group II hydrotralcite as described in WO2007/147866. Lanthanides may also be used. Such narrower distribution alcohol ethoxylates are available from Azo Nobel and Sasol.

15

Preferably the narrow ethoxy distribution has greater than 70 wt.%, more preferably greater than 80 w.t% of the ether sulfate  $R_2-O-(CH_2CH_2O)_pSO_3H$  in the range  $R_2-O-(CH_2CH_2O)_zSO_3H$  to  $R_2-O-(CH_2CH_2O)_wSO_3H$  where q is the mole average degree of ethoxylation and x and y are absolute numbers, where  $z = p-p/2$  and  $w = p+p/2$ . For example when  $p=6$ , then greater than 70 wt.% of the ether sulfate should consist of ether sulfate with 3, 4, 5, 6, 7, 8, 9 ethoxylate groups.

20

25 The ether sulfate weight is calculated as the protonated form:  $R_2-O-(CH_2CH_2O)_pSO_3H$ . In the formulation it will be present as the ionic form  $R_2-O-(CH_2CH_2O)_pSO_3^-$  with a corresponding counter ion, preferred counter ions are group I and II metals, amines, most preferably sodium.

30 Where the composition comprises a mixture of the C16/18 sourced material for the alkyl ether sulphate as well as the more traditional C12 alkyl chain length materials it is preferred that the C16/18 alkyl ether sulphate should comprise at least 10% wt. of the total alkyl ether sulphate, more preferably at least 50%, even more preferably at least



70%, especially preferably at least 90% and most preferably at least 95% of alkyl ether sulphate in the composition.

5 Preferably the weight ratio of the surfactant MEE:C1618AES is from 2:1 to 1:2, most preferably 1:1.

The composition may comprise further surfactants and preferably other anionic and/or non-ionic surfactants, for example alkyl ether sulphates or alcohol ethoxylates comprising C12 to C18 alkyl chains. In such instances that surfactant sources comprise C18 chains,  
10 it is preferred that at least 30% wt of the total C18 surfactant is a methyl ester ethoxylate surfactant.

15 Preferably the methyl ester ethoxylate and C18 AES surfactant is used in combination with further anionic surfactant. Preferably the weight fraction of methyl ester ethoxylate surfactant/total anionic surfactant is from 0.1 to 9, more preferably 0.15 to 2, most preferably 0.2 to 1. By total anionic surfactant means the total content of any of the preferred classes of anionic surfactant including ether sulfates, linear alkyl benzene sulfonates, alkyl ether carboxylates, alkyl sulfates, rhamnolipids and mixtures thereof. Preferably, the total level of surfactant in the formulation is from 4 to 95wt%, more  
20 preferably 4 to 50wt%, most preferably 4 to 30wt%.

Preferably linear alkyl benzene sulfonates (LAS), are present in the formulation.

25 Preferably the weight ratio of LAS: MEE is 2:1 to 1:2. A more preferred weight ratio range of LAS:MEE:C1618AES is 1:1:1 to 3:1:1.

Preferably, the composition is visually clear.

#### Liquid laundry detergents

30 The term "laundry detergent" in the context of this invention denotes formulated compositions intended for and capable of wetting and cleaning domestic laundry such as clothing, linens and other household textiles. The object of the invention is to provide a composition which on dilution is capable of forming a liquid laundry detergent composition and in the manner now described.

In a preferred embodiment the liquid composition is isotropic.

The term “linen” is often used to describe certain types of laundry items including bed sheets, pillow cases, towels, tablecloths, table napkins and uniforms. Textiles can include  
5 woven fabrics, non-woven fabrics, and knitted fabrics; and can include natural or synthetic fibres such as silk fibres, linen fibres, cotton fibres, polyester fibres, polyamide fibres such as nylon, acrylic fibres, acetate fibres, and blends thereof including cotton and polyester blends.

10 Examples of liquid laundry detergents include heavy-duty liquid laundry detergents for use in the wash cycle of automatic washing machines, as well as liquid fine wash and liquid colour care detergents such as those suitable for washing delicate garments (e.g. those made of silk or wool) either by hand or in the wash cycle of automatic washing machines.

15 The term “liquid” in the context of this invention denotes that a continuous phase or predominant part of the composition is liquid and that the composition is flowable at 15°C and above. Accordingly, the term “liquid” may encompass emulsions, suspensions, and compositions having flowable yet stiffer consistency, known as gels or pastes. The  
20 viscosity of the composition is preferably from 200 to about 10,000 mPa.s at 25°C at a shear rate of 21 sec<sup>-1</sup>. This shear rate is the shear rate that is usually exerted on the liquid when poured from a bottle. Pourable liquid detergent compositions preferably have a viscosity of from 200 to 1,500 mPa.s, preferably from 200 to 700 mPa.s.

25 A composition according to the invention may suitably have an aqueous continuous phase. By “aqueous continuous phase” is meant a continuous phase which has water as its basis. Preferably, the composition comprises at least 50% wt. water and more preferably at least 70% wt. water.

30 A composition of the invention suitably comprises from 5 to 60% and preferably from 10 to 40% (by weight based on the total weight of the composition) of one or more detergent surfactants.

The term "detergent surfactant" in the context of this invention denotes a surfactant which provides a detergent (i.e. cleaning) effect to laundry treated as part of a domestic laundering process.

## 5 **Further Anionic-surfactants**

Anionic Surfactant are described in Anionic Surfactants Organic Chemistry (Surfactant Science Series Volume 56) edited By H.W.Stache (Marcel Dekker 1996).

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

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

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

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

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

The alkyl ether sulphate may be provided in a single raw material component or by way of  
10 a mixture of components.

Most preferably, the composition comprises LAS and C18 AES in addition to the MEE.

#### **Non-ionic surfactants**

15 Preferably, the composition comprises from 0 to 20% wt. non-ionic surfactant based on the total weight of composition other than the MEE component. Suitable nonionic surfactants other than MEE, include, polyoxyalkylene compounds, i.e. the reaction product of alkylene oxides (such as ethylene oxide or propylene oxide or mixtures thereof) with starter molecules having a hydrophobic group and a reactive hydrogen atom  
20 which is reactive with the alkylene oxide. Such starter molecules include alcohols, acids, amides or alkyl phenols. Where the starter molecule is an alcohol, the reaction product is known as an alcohol alkoxyate. The polyoxyalkylene compounds can have a variety of block and heteric (random) structures. For example, they can comprise a single block of alkylene oxide, or they can be diblock alkoxyates or triblock alkoxyates. Within the block  
25 structures, the blocks can be all ethylene oxide or all propylene oxide, or the blocks can contain a heteric mixture of alkylene oxides. Examples of such materials include C<sub>8</sub> to C<sub>22</sub> alkyl phenol ethoxyates with an average of from 5 to 25 moles of ethylene oxide per mole of alkyl phenol; and aliphatic alcohol ethoxyates such as C<sub>8</sub> to C<sub>18</sub> primary or  
30 secondary linear or branched alcohol ethoxyates with an average of from 2 to 40 moles of ethylene oxide per mole of alcohol.

A preferred class of additional nonionic surfactant for use in the invention includes aliphatic C<sub>8</sub> to C<sub>18</sub>, more preferably C<sub>12</sub> to C<sub>15</sub> primary linear alcohol ethoxyates with an

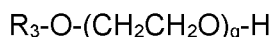
average of from 3 to 20, more preferably from 5 to 10 moles of ethylene oxide per mole of alcohol.

The alcohol ethoxylate may be provided in a single raw material component or by way of  
5 a mixture of components.

A further preferred non-ionic surfactant are the C16/18 Alcohol ethoxylates.

### **C16/C18 Alcohol Ethoxylate**

10 The C16/18 alcohol ethoxylate is of the formula:



where  $R_3$  is selected from saturated, monounsaturated and polyunsaturated linear C16  
15 and C18 alkyl chains and where  $q$  is from 4 to 20, preferably 5 to 14, more preferably 8 to 12. The mono-unsaturation is preferably in the 9 position of the chain, where the carbons are counted from the ethoxylate bound chain end. The double bond may be in a cis or trans configuration (oleyl or elaidyl), preferably cis. The cis or trans alcohol ethoxylate  $CH_3(CH_2)_7-CH=CH-(CH_2)_8O-(OCH_2CH_2)_nOH$ , is described as C18:1( $\Delta$ 9) alcohol  
20 ethoxylate. This follows the nomenclature CX:Y( $\Delta$ Z) where X is the number of carbons in the chain, Y is the number of double bonds and  $\Delta$ Z the position of the double bond on the chain where the carbons are counted from the OH bound chain end.

Preferably,  $R_3$  is selected from saturated C16, saturated C18 and monounsaturated C18.  
25 More preferably, the saturated C16 alcohol ethoxylate is at least 90% wt. of the total C16 linear alcohol ethoxylate. As regards the C18 alcohol ethoxylate content, it is preferred that the predominant C18 moiety is C18:1, more preferably C18:1( $\Delta$ 9). The proportion of monounsaturated C18 alcohol ethoxylate constitutes at least 50% wt. of the total C16 and C18 alcohol ethoxylate surfactant. Preferably, the proportion of monounsaturated C18  
30 constitutes at least 60% wt., most preferably at least 75 of the total C16 and C18 alcohol ethoxylate surfactant.

Preferably, the C16 alcohol ethoxylate surfactant comprises at least 2% wt. and more preferably, from 4% of the total C16 and C18 alcohol ethoxylate surfactant.

Preferably, the saturated C18 alcohol ethoxylate surfactant comprises up to 20% wt. and more preferably, up to 11% of the total C16 and C18 alcohol ethoxylate surfactant.

5 Preferably the saturated C18 content is at least 2% wt. of the total C16 and C18 alcohol ethoxylate content.

Alcohol ethoxylates are discussed in the Non-ionic Surfactants: Organic Chemistry edited by Nico M. van Os (Marcel Dekker 1998), Surfactant Science Series published by CRC press. Alcohol ethoxylates are commonly referred to as alkyl ethoxylates.

10

Preferably the weight fraction of C18 alcohol ethoxylate / C16 alcohol ethoxylate is greater than 1, more preferably from 2 to 100, most preferably 3 to 30. 'C18 alcohol ethoxylate' is the sum of all the C18 fractions in the alcohol ethoxylate, not including the MEE and 'C16 alcohol ethoxylate' is the sum of all the C16 fractions in the alcohol ethoxylate, not including the MEE.

15

Linear saturated or mono-unsaturated C20 and C22 alcohol ethoxylate may also be present. Preferably the weight fraction of sum of 'C18 alcohol ethoxylate' / 'C20 and C22 alcohol ethoxylate' is greater than 10.

20

Preferably the C16/18 alcohol ethoxylate contains less than 15wt%, more preferably less than 8wt%, most preferably less than 5wt% of the alcohol ethoxylate polyunsaturated alcohol ethoxylates. A polyunsaturated alcohol ethoxylate contains a hydrocarbon chains with two or more double bonds.

25

C16/18 alcohol ethoxylates may be synthesised by ethoxylation of an alkyl alcohol, via the reaction:



30

The alkyl alcohol may be produced by transesterification of the triglyceride to a methyl ester, followed by distillation and hydrogenation to the alcohol. The process is discussed in Journal of the American Oil Chemists' Society. 61 (2): 343–348 by Kreutzer, U. R.

Preferred alkyl alcohol for the reaction is oleyl alcohol within an iodine value of 60 to 80, preferably 70 to 75, such alcohol are available from BASF, Cognis, Ecogreen.

Production of the fatty alcohol is further discussed in Sanchez M.A. et al

J.Chem.Technol.Biotechnol 2017; 92:27-92 and Ullmann's Enzyklopaedie der

5 technischen Chemie, Verlag Chemie, Weinheim, 4th Edition, Vol. 11, pages 436 et seq.

Preferably the ethoxylation reactions are base catalysed using NaOH, KOH, or NaOCH<sub>3</sub>.

Even more preferred are catalyst which provide narrower ethoxy distribution than NaOH, KOH, or NaOCH<sub>3</sub>. Preferably these narrower distribution catalysts involve a Group II

base such as Ba dodecanoate; Group II metal alkoxides; Group II hydrotricalcinate as

10 described in WO2007/147866. Lanthanides may also be used. Such narrower

distribution alcohol ethoxylates are available from Azo Nobel and Sasol.

Preferably the narrow ethoxy distribution has greater than 70 wt.%, more preferably

greater than 80 wt.% of the alcohol ethoxylate R-O-(CH<sub>2</sub>CH<sub>2</sub>O)<sub>q</sub>-H in the range R-O-

(CH<sub>2</sub>CH<sub>2</sub>O)<sub>x</sub>-H to R-O-(CH<sub>2</sub>CH<sub>2</sub>O)<sub>y</sub>-H where q is the mole average degree of ethoxylation

15 and x and y are absolute numbers, where  $x = q - q/2$  and  $y = q + q/2$ . For example when

q=10, then greater than 70 wt.% of the alcohol ethoxylate should consist of ethoxylate with 5, 6, 7, 8, 9, 10, 11, 12, 13, 14 and 15 ethoxylate groups.

Where the composition comprises a mixture of the C16/18 sourced material for the

20 alcohol ethoxylate as well as the more traditional C12 alkyl chain length materials it is

preferred that the C16/18 alcohol ethoxylate should comprise at least 10% wt. total

alcohol ethoxylate, more preferably at least 50%, even more preferably at least 70%,

especially preferably at least 90% and most preferably at least 95% of the alcohol ethoxylate in the composition.

25

A further class of non-ionic surfactants include the alkyl poly glycosides and rhamnolipids.

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

Preferably, the selection and amount of surfactant is such that the composition and the

30 diluted mixture are isotropic in nature.

### Source of alkyl chains

The alkyl chain of C16/18 surfactant whether an alcohol ethoxylate or an alkyl ether

sulphate is preferably obtained from a renewable source, preferably from a triglyceride. A

renewable source is one where the material is produced by natural ecological cycle of a living species, preferably by a plant, algae, fungi, yeast or bacteria, more preferably plants, algae or yeasts.

- 5 Preferred plant sources of oils are rapeseed, sunflower, maize, soy, cottonseed, olive oil and trees. The oil from trees is called tall oil. Most preferably Palm and Rapeseed oils are the source.

10 Algal oils are discussed in *Energies* 2019, 12, 1920 *Algal Biofuels: Current Status and Key Challenges* by Saad M.G. et al. A process for the production of triglycerides from biomass using yeasts is described in *Energy Environ. Sci.*, 2019,12, 2717 *A sustainable, high-performance process for the economic production of waste-free microbial oils that can replace plant-based equivalents* by Masri M.A. et al.

15 Non edible plant oils may be used and are preferably selected from the fruit and seeds of *Jatropha curcas*, *Calophyllum inophyllum*, *Sterculia foetida*, *Madhuca indica* (mahua), *Pongamia glabra* (korocho seed), Linseed, *Pongamia pinnata* (karanja), *Hevea brasiliensis* (Rubber seed), *Azadirachta indica* (neem), *Camelina sativa*, *Lesquerella fendleri*, *Nicotiana tabacum* (tobacco), Deccan hemp, *Ricinus communis* L.(castor), *Simmondsia chinensis* (Jojoba), *Eruca sativa* L., *Cerbera odollam* (Sea mango), Coriander (*Coriandrum sativum* L.), *Croton megalocarpus*, Pilu, *Crambe*, *syringa*, *Scheleichera triguga* (kusum), *Stillingia*, *Shorea robusta* (sal), *Terminalia belerica roxb*, *Cuphea*, *Camellia*, *Champaca*, *Simarouba glauca*, *Garcinia indica*, Rice bran, Hingan (balanites), Desert date, Cardoon, *Asclepias syriaca* (Milkweed), *Guizotia abyssinica*, Radish

20 Ethiopian mustard, *Syagrus*, Tung, *Idesia polycarpa* var. *vestita*, Alagae, *Argemone mexicana* L. (Mexican prickly poppy), *Putranjiva roxburghii* (Lucky bean tree), *Sapindus mukorossi* (Soapnut), *M. azedarach* (syringe), *Thevetia peruviana* (yellow oleander), *Copaiba*, Milk bush, Laurel, *Cumaru*, *Andiroba*, *Piqui*, *B. napus*, *Zanthoxylum bungeanum*.

30

#### **ETHOXYLATED GLYCEROL ESTER**

Preferably, the composition comprises an ethoxylated glycerol ester.



The ethoxylated glycerol ester used in embodiments of the invention comprise an ethoxy group ether bound to each on the hydroxy groups of the glycerol. In turn, one, two or three of these ethoxy groups is esterified with a fatty acid.

- 5 Preferably, the ethoxylated glycerol ester comprises from 3 to 30 EO groups, more preferably from 5 to 25 and most preferably from 12 to 21 ethoxy groups.

10 Preferably, the number of ethoxy groups in the ethoxylated glycerol ester is a weight average. Similarly, it is preferred that the number of carbon atoms in each fatty acid is a weight average.

In regard to ethoxylation number, fatty acid constitution and number of fatty acids, it is expected that any raw material comprises a range of molecules and so these definitions relate to an average.

15

Preferably, the fatty acids are alkyl or straight chain fatty acids and are saturated or unsaturated. More preferably, the fatty acids are straight chain and also preferred are fatty acids which are straight chain.

- 20 Preferably, the fatty acids comprise from 5 to 30 carbon atoms in the alkyl chain, more preferably from 8 to 22 and most preferably from 10 to 18.

25 Preferably, the ethoxylated glycerol ester comprises coconut fatty acid esters. Coconut or coco fatty acids include around 82%wt. saturated fatty acids and of the total fatty acid content lauric acid is the most common at around 48% wt. of the fatty acid content. Myristic acid (16%) and palmitic acid (9.5%) are the next most common. Oleic acid is the most common unsaturated acid present at around 6.5% wt. of the fatty acid content.

30 Preferably, the ethoxylated glycerol ester comprises palm oil fatty acid esters. Palm oil has a balanced fatty acid composition in which the level of saturated fatty acids is almost equal to that of the unsaturated fatty acids. Palmitic acid (44%-45%) and oleic acid (39%-40%) are the major component acids, with linoleic acid (10%-11%) and only a trace amount of linolenic acid.

The most preferred ethoxylated glyceryl ester is glycereth-17 cocoate.

Certain of the ethoxylated glyceryl esters are commercially available from Kao under the Levenol brand name.

5

Variants such as Levenol F-200 which has an average EO of 6 and a molar ratio between glycerol and coco fatty acid of 0.55, Levenol V501/2 which has an average EO of 17 and a molar ratio between glycerol and coco fatty acid of 1.5 and Levenol C201 which is also known as glycereth-17 cocoate.

10

The ethoxylated glycerol ester is preferably present at from 0.1 to 10% wt. of the composition.

#### ANTI-FOAM

15

The composition may also comprise an anti-foam but it is preferred that it does not. Anti-foam materials are well known in the art and include silicones and fatty acid.

Preferably, fatty acid soap is present at from 0 to 0.5% wt. of the composition (as measured with reference to the acid added to the composition), more preferably from 0 to 0.1% wt. and most preferably zero.

20

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

25  
30

The fatty acids may be present in the form of their sodium, potassium or ammonium salts and/or in the form of soluble salts of organic bases, such as mono-, di- or triethanolamine.

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

For formula accounting purposes, in the formulation, fatty acids and/or their salts (as defined above) are not included in the level of surfactant or in the level of builder.

Preferably, the composition comprises 0.2 to 10wt% of the composition cleaning polymer.

5 Preferably, the cleaning polymer is selected from alkoxyolate polyamines, polyester soil release polymers and co-polymer of PEG/vinyl acetate.

### **PRESERVATIVE**

The composition preferably comprises a preservative.

10

Preferably, the composition comprises a preservative to inhibit microbial growth. For example, preservatives may optionally be included in various embodiments as a way to further boost microbial protection for gross bacteria, virus and/or fungi contamination introduced e.g., by a consumer, through a contaminated ingredient, contaminated storage  
15 container, equipment, processing step or other source. Any conventional preservative known in the art may be used. Some illustrative preservatives include: potassium sorbate, sodium benzoate, benzoic acid, phenoxyethanol, benzyl alcohol, dehydroxyacetic acid, sodium borate, boric acid, usinic acid, phenols, quaternary ammonia compounds, glycols, isothiazolinones (methyl, benzyl, chloro), DMDM hydantoin, hexidine, ethanol, IPBC,  
20 polyaminopropyl biguanide, phenylphenol, imidazolidinyl urea, parabens, formaldehyde, salicylic acid or salts, caprylyl glycol, D-glucono-1,5 lactone, sodium erythorbate, sodium hydroxymethylglycinate, peroxides, sodium sulphite, bisulphite, glucose oxidase, lacto peroxidase, and other preservatives compatible with the cleaning ingredients. Some other  
25 natural materials might also be considered like cinnamon, fruit acids, essential oils like thyme and rosemary, willow bark, aspen bark, tocopherol, curry, citrus extracts, honeysuckle, and amino acid based preservatives. Especially preferred are preservatives that do not compete with the cleaning ingredients and do not have reported health or environmental issues. Some of the more preferred preservatives are: phenoxyethanol, benzoic acid/potassium sorbate, enzymes, borates, isothiazolinones such as MIT, BIT  
30 and CIT, and the natural solutions above. In one embodiment, the preservative is present in an amount less than about 5 wt. percent based on the total weight of the cleaning composition. In another embodiment, the preservative is present in an amount from about 0.01 to about 2 wt. percent. In another embodiment, the fragrant agent is present in an amount from about 0.01 to about 1 wt. percent.

Further preferred preservatives include itaconic acid and phenoxyethanol.

More preferably the composition comprises BIT and/or MIT at a combined level of not more than 550 ppm and more preferably at from 300 to 450 ppm. Preferably, the level of  
5 MIT does not exceed 95 ppm. Preferably, the level of BIT does not exceed 450 ppm.

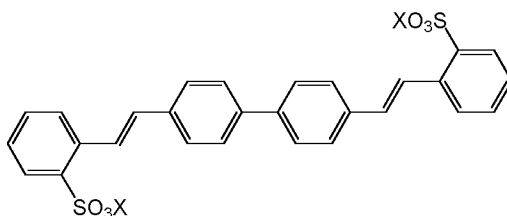
Most preferably, the composition comprises benzoate salt as preservative. Preferably the benzoate salt is present at from 0.01 to 3% wt. more preferably 0.1 to 2% wt, most preferably 0.5 to 1.5% wt. of the composition.

10

### FLUORESCER

Sulphonated distyrylbiphenyl fluoescers are discussed in Chapter 7 of Industrial Dyes (K. Hunger ed, Wiley VCH 2003).

15 Sulfonated distyrylbiphenyl fluoescer are discussed in US5145991 (Ciba Geigy).  
4,4'- distyrylbiphenyl are preferred. Preferably the fluoescer contains 2  $\text{SO}_3^-$  groups.  
Most preferably the fluoescer is of the structure:



20

Where X is suitable counter ion, preferably selected from metal ions, ammonium ions, or amine salt ions, more preferably alkali metal ions, ammonium ions or amine salt ions, most preferably Na or K.

25 Preferably the fluoescer is present at levels of 0.01wt% to 1wt% of the composition, more preferably from 0.05 to 0.4wt%., most preferably 0.11 to 0.3wt%.

The C16 and/or C18 alkyl based surfactant, whether the alcohol ethoxylate or the alkyl ether sulphate is typically available as a mixture with C16 and C18 alkyl chain length raw  
30 material.

### **POLYMERIC CLEANING BOOSTERS**

Anti-redeposition polymers stabilise the soil in the wash solution thus preventing redeposition of the soil. Suitable soil release polymers for use in the invention include alkoxyated polyethyleneimines and alkoxyated oligoamines. Alkoxyated oligoamines are preferably selected from sulfated zwitterionic ethoxyated hexamethylenediamine, ethoxyated hexamethylene diamine, ethoxyated tetraethylene pentaamine,  $((C_2H_5O)(C_2H_4O)_n)(CH_3)-N^+-C_xH_{2x}-N^+-(CH_3)-$  bis $((C_2H_5O)(C_2H_4O)_n)$ . The preferred degree of ethoxylation of from 15 to 25 EO groups per NH. Zwitterionic character may be achieved by alkylation, preferably methylation of the N groups.

Polyethyleneimines are materials composed of ethylene imine units  $-CH_2CH_2NH-$  and, where branched, the hydrogen on the nitrogen is replaced by another chain of ethylene imine units. Preferred alkoxyated polyethyleneimines for use in the invention have a polyethyleneimine backbone of about 300 to about 10000 weight average molecular weight ( $M_w$ ). The polyethyleneimine backbone may be linear or branched. It may be branched to the extent that it is a dendrimer. The alkoxylation may typically be ethoxylation or propoxylation, or a mixture of both. Where a nitrogen atom is alkoxyated, a preferred average degree of alkoxylation is from 10 to 30, preferably from 15 to 25 alkoxy groups per modification. A preferred material is ethoxyated polyethyleneimine, with an average degree of ethoxylation being from 10 to 30, preferably from 15 to 25 ethoxy groups per ethoxyated nitrogen atom in the polyethyleneimine backbone.

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

A composition of the invention will preferably comprise from 0.025 to 8% wt. of one or more anti-redeposition polymers such as, for example, the alkoxyated polyethyleneimines which are described above.

### **SOIL RELEASE POLYMERS**

Soil release polymers help to improve the detachment of soils from fabric by modifying the fabric surface during washing. The adsorption of a SRP over the fabric surface is promoted by an affinity between the chemical structure of the SRP and the target fibre. SRPs for use in the invention may include a variety of charged (e.g. anionic) as well as non-charged monomer units and structures may be linear, branched or star-shaped. The

SRP structure may also include capping groups to control molecular weight or to alter polymer properties such as surface activity. The weight average molecular weight ( $M_w$ ) of the SRP may suitably range from about 1000 to about 20,000 and preferably ranges from about 1500 to about 10,000.

5

SRPs for use in the invention may suitably be selected from copolyesters of dicarboxylic acids (for example adipic acid, phthalic acid or terephthalic acid), diols (for example ethylene glycol or propylene glycol) and polydiols (for example polyethylene glycol or polypropylene glycol). The copolyester may also include monomeric units substituted with

10

anionic groups, such as for example sulfonated isophthaloyl units. Examples of such materials include oligomeric esters produced by transesterification/oligomerization of poly(ethyleneglycol) methyl ether, dimethyl terephthalate ("DMT"), propylene glycol ("PG") and poly(ethyleneglycol) ("PEG"); partly- and fully-anionic-end-capped oligomeric esters

15

such as oligomers from ethylene glycol ("EG"), PG, DMT and Na-3,6-dioxa-8-hydroxyoctanesulfonate; nonionic-capped block polyester oligomeric compounds such as those produced from DMT, Me-capped PEG and EG and/or PG, or a combination of DMT, EG and/or PG, Me-capped PEG and Na-dimethyl-5-sulfoisophthalate, and copolymeric blocks of ethylene terephthalate or propylene terephthalate with polyethylene oxide or polypropylene oxide terephthalate.

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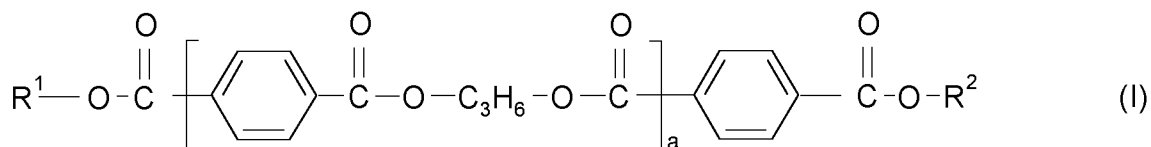
Other types of SRP for use in the invention include cellulosic derivatives such as hydroxyether cellulosic polymers,  $C_1$ - $C_4$  alkylcelluloses and  $C_4$  hydroxyalkyl celluloses; polymers with poly(vinyl ester) hydrophobic segments such as graft copolymers of poly(vinyl ester), for example  $C_1$ - $C_6$  vinyl esters (such as poly(vinyl acetate)) grafted onto

25

polyalkylene oxide backbones; poly(vinyl caprolactam) and related co-polymers with monomers such as vinyl pyrrolidone and/or dimethylaminoethyl methacrylate; and polyester-polyamide polymers prepared by condensing adipic acid, caprolactam, and polyethylene glycol.

30

Preferred SRPs for use in the invention include copolyesters formed by condensation of terephthalic acid ester and diol, preferably 1,2 propanediol, and further comprising an end cap formed from repeat units of alkylene oxide capped with an alkyl group. Examples of such materials have a structure corresponding to general formula (I):



in which  $R^1$  and  $R^2$  independently of one another are  $X-(OC_2H_4)_n-(OC_3H_6)_m$ ;

5 in which X is  $C_{1-4}$  alkyl and preferably methyl;

n is a number from 12 to 120, preferably from 40 to 50;

m is a number from 1 to 10, preferably from 1 to 7; and

10

a is a number from 4 to 9.

Because they are averages, m, n and a are not necessarily whole numbers for the polymer in bulk.

15

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

The overall level of SRP, when included, may range from 0.1 to 10%, depending on the level of polymer intended for use in the final diluted composition and which is desirably  
 20 from 0.3 to 7%, more preferably from 0.5 to 5% (by weight based on the total weight of the diluted composition).

Suitable soil release polymers are described in greater detail in U. S. Patent Nos. 5,574,179; 4,956,447; 4,861,512; 4,702,857, WO 2007/079850 and WO2016/005271. If  
 25 employed, soil release polymers will typically be incorporated into the liquid laundry detergent compositions herein in concentrations ranging from 0.01 percent to 10 percent, more preferably from 0.1 percent to 5 percent, by weight of the composition.

### HYDROTROPES

30 A composition of the invention may incorporate non-aqueous carriers such as hydrotropes, co-solvents and phase stabilizers. Such materials are typically low

molecular weight, water-soluble or water-miscible organic liquids such as C1 to C5 monohydric alcohols (such as ethanol and n- or i-propanol); C2 to C6 diols (such as monopropylene glycol and dipropylene glycol); C3 to C9 triols (such as glycerol); polyethylene glycols having a weight average molecular weight ( $M_w$ ) ranging from about  
5 200 to 600; C1 to C3 alkanolamines such as mono-, di- and triethanolamines; and alkyl aryl sulfonates having up to 3 carbon atoms in the lower alkyl group (such as the sodium and potassium xylene, toluene, ethylbenzene and isopropyl benzene (cumene) sulfonates).

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

Non-aqueous carriers, when included, may be present in an amount ranging from 0.1 to 3%, preferably from 0.5 to 1% (by weight based on the total weight of the composition). The level of hydrotrope used is linked to the level of surfactant and it is desirable to use  
15 hydrotrope level to manage the viscosity in such compositions. The preferred hydrotropes are monopropylene glycol and glycerol.

However, given that the benefit of the claimed combination of MEE and AES it is preferred that the level of hydrotrope is less than 0.2% by weight of the composition.

20

Preferably, the level of monopropylene glycol is less than 0.2% wt. of the composition.

### **COSURFACTANTS**

A composition of the invention may contain one or more cosurfactants (such as  
25 amphoteric (zwitterionic) and/or cationic surfactants) in addition to the non-soap anionic and/or nonionic deterative surfactants described above.

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



Specific amphoteric (zwitterionic) surfactants include alkyl amine oxides, alkyl betaines, alkyl amidopropyl betaines, alkyl sulfobetaines (sultaines), alkyl glycinates, alkyl carboxyglycinates, alkyl amphoacetates, alkyl amphopropionates, alkylamphoglycinates, alkyl amidopropyl hydroxysultaines, acyl taurates and acyl glutamates, having alkyl radicals containing from about 8 to about 22 carbon atoms preferably selected from C12, C14, C16, C18 and C18:1, the term "alkyl" being used to include the alkyl portion of higher acyl radicals. Amphoteric (zwitterionic) surfactant, when included, may be present in an amount ranging from 0.1 to 5% (by weight based on the total weight of the composition).

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

#### **BUILDERS AND SEQUESTRANTS**

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

Other suitable organic builders include the higher molecular weight polymers and copolymers known to have builder properties. For example, such materials include appropriate polyacrylic acid, polymaleic acid, and polyacrylic/polymaleic acid copolymers and their salts, for example those sold by BASF under the name SOKALAN™. If utilized, the organic builder materials may comprise from about 0.5 percent to 20 wt percent, preferably from 1 wt percent to 10 wt percent, of the composition. The preferred builder level is less than 10 wt percent and preferably less than 5 wt percent of the composition. More preferably the liquid laundry detergent formulation is a non-phosphate built laundry detergent formulation, i.e., contains less than 1 wt.% of phosphate. Most preferably the laundry detergent formulation is not built i.e. contain less than 1 wt.% of builder. A preferred sequestrant is HEDP (1-Hydroxyethylidene-1,1-diphosphonic acid), for example sold as Dequest 2010. Also suitable but less preferred as it gives inferior

cleaning results is Dequest(R) 2066 (Diethylenetriamine penta(methylene phosphonic acid or Heptasodium DTPMP).

### **POLYMERIC THICKENERS**

5 A composition of the invention may comprise one or more polymeric thickeners. Suitable polymeric thickeners for use in the invention include hydrophobically modified alkali swellable emulsion (HASE) copolymers. Exemplary HASE copolymers for use in the invention include linear or crosslinked copolymers that are prepared by the addition polymerization of a monomer mixture including at least one acidic vinyl monomer, such  
10 as (meth)acrylic acid (i.e. methacrylic acid and/or acrylic acid); and at least one associative monomer. The term "associative monomer" in the context of this invention denotes a monomer having an ethylenically unsaturated section (for addition polymerization with the other monomers in the mixture) and a hydrophobic section. A preferred type of associative monomer includes a polyoxyalkylene section between the  
15 ethylenically unsaturated section and the hydrophobic section. Preferred HASE copolymers for use in the invention include linear or crosslinked copolymers that are prepared by the addition polymerization of (meth)acrylic acid with (i) at least one associative monomer selected from linear or branched C<sub>8</sub>-C<sub>40</sub> alkyl (preferably linear C<sub>12</sub>-C<sub>22</sub> alkyl) polyethoxylated (meth)acrylates; and (ii) at least one further monomer selected  
20 from C<sub>1</sub>-C<sub>4</sub> alkyl (meth) acrylates, polyacidic vinyl monomers (such as maleic acid, maleic anhydride and/or salts thereof) and mixtures thereof. The polyethoxylated portion of the associative monomer (i) generally comprises about 5 to about 100, preferably about 10 to about 80, and more preferably about 15 to about 60 oxyethylene repeating units. Mixtures of any of the above described materials may also be used.

25 When included, a composition of the invention will preferably comprise from 0.01 to 5% wt. of the composition but depending on the amount intended for use in the final diluted product and which is desirably from 0.1 to 3% wt. by weight based on the total weight of the diluted composition.

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### **SHADING DYES**

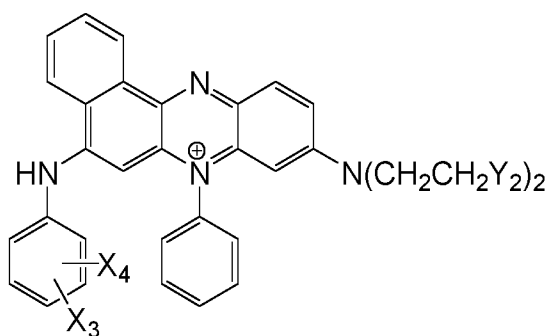
Shading dye can be used to improve the performance of the compositions. Preferred dyes are violet or blue. It is believed that the deposition on fabrics of a low level of a dye

of these shades, masks yellowing of fabrics. A further advantage of shading dyes is that they can be used to mask any yellow tint in the composition itself.

Shading dyes are well known in the art of laundry liquid formulation.

- 5 Suitable and preferred classes of dyes include direct dyes, acid dyes, hydrophobic dyes, basic dyes, reactive dyes and dye conjugates.

Preferred examples are Disperse Violet 28, Acid Violet 50, anthraquinone dyes covalently bound to ethoxylate or propoxylated polyethylene imine as described in WO2011/047987  
 10 and WO 2012/119859 alkoxyated mono-azo thiophenes, dye with CAS-No 72749-80-5, acid blue 59, and the phenazine dye selected from:



- 15 wherein:

$X_3$  is selected from: -H; -F; -CH<sub>3</sub>; -C<sub>2</sub>H<sub>5</sub>; -OCH<sub>3</sub>; and, -OC<sub>2</sub>H<sub>5</sub>;

$X_4$  is selected from: -H; -CH<sub>3</sub>; -C<sub>2</sub>H<sub>5</sub>; -OCH<sub>3</sub>; and, -OC<sub>2</sub>H<sub>5</sub>;

20

$Y_2$  is selected from: -OH; -OCH<sub>2</sub>CH<sub>2</sub>OH; -CH(OH)CH<sub>2</sub>OH; -OC(O)CH<sub>3</sub>; and, C(O)OCH<sub>3</sub>.

Alkoxyated thiophene dyes are discussed in WO2013/142495 and WO2008/087497.

- 25 The shading dye is preferably present in the composition in range from 0.0001 to 0.1wt %. Depending upon the nature of the shading dye there are preferred ranges depending upon the efficacy of the shading dye which is dependent on class and particular efficacy within any particular class.

### EXTERNAL STRUCTURANTS

Compositions of the invention may have their rheology further modified by use of one or more external structurants which form a structuring network within the composition.

5 Examples of such materials include hydrogenated castor oil, microfibrinous cellulose and citrus pulp fibre. The presence of an external structurant may provide shear thinning rheology and may also enable materials such as encapsulates and visual cues to be suspended stably in the liquid.

### ENZYMES

10 A composition of the invention may comprise an effective amount of one or more enzyme preferably selected from the group comprising, hemicellulases, peroxidases, proteases, cellulases, hemicellulases, xylanases, xanthanase, lipases, phospholipases, esterases, cutinases, pectinases, carrageenases, mannanases, pectate lyases, keratinases, reductases, oxidases, phenoloxidases, lipoxygenases, ligninases, pullulanases,

15 tannases, pentosanases, malanases,  $\beta$ -glucanases, arabinosidases, hyaluronidase, chondroitinase, laccase, tannases, amylases, nucleases (such as deoxyribonuclease and/or ribonuclease), phosphodiesterases, or mixtures thereof. Particularly preferred are mixtures of protease, amylase, lipase, cellulase, phosphodiesterase, and/or pectate lyase.

20 Preferably the level of an enzyme is from 0.1 to 100, more preferably from 0.5 to 50, most preferably from 1 to 30 mg active enzyme protein per 100g finished product.

25 Preferably the protease enzyme is present in the greatest weight fraction. Preferably the protease is present at levels that are greater than 3 times any other single enzyme.

Examples of preferred enzymes are sold under the following trade names Purafect Prime®, Purafect®, Preferenz® (DuPont), Savinase®, Pectawash®, Mannaway®, Lipex®, Lipoclean®, Whitzyme®, Stainzyme®, Stainzyme Plus®, Natalase®, Mannaway®,

30 Amplify® Xpect®, Celluclean® (Novozymes), Biotouch (AB Enzymes), Lavergy® (BASF).

Detergent enzymes are discussed in WO2020/186028(Procter and Gamble), WO2020/200600 (Henkel), WO2020/070249 (Novozymes), WO2021/001244 (BASF) and WO2020/259949 (Unilever).

- 5 A nuclease enzyme is an enzyme capable of cleaving the phosphodiester bonds between the nucleotide sub-units of nucleic acids and is preferably a deoxyribonuclease or ribonuclease enzyme. Preferably the nuclease enzyme is a deoxyribonuclease, preferably selected from any of the classes E.C. 3.1.21.x, where x=1, 2, 3, 4, 5, 6, 7, 8 or 9, E.C. 3.1.22.y where y=1, 2, 4 or 5, E.C. 3.1.30.Z where z= 1 or 2, E.C. 3.1.31.1 and  
10 mixtures thereof.

### **FRAGRANCES**

Fragrances are well known in the art and may be incorporated into compositions described herein.

15

### **MICROCAPSULES**

One type of microparticle suitable for use in the invention is a microcapsule.

- Microencapsulation may be defined as the process of surrounding or enveloping one substance within another substance on a very small scale, yielding capsules ranging from  
20 less than one micron to several hundred microns in size. The material that is encapsulated may be called the core, the active ingredient or agent, fill, payload, nucleus, or internal phase. The material encapsulating the core may be referred to as the coating, membrane, shell, or wall material.

- 25 Microcapsules typically have at least one generally spherical continuous shell surrounding the core. The shell may contain pores, vacancies or interstitial openings depending on the materials and encapsulation techniques employed. Multiple shells may be made of the same or different encapsulating materials, and may be arranged in strata of varying thicknesses around the core. Alternatively, the microcapsules may be  
30 asymmetrically and variably shaped with a quantity of smaller droplets of core material embedded throughout the microcapsule.

The shell may have a barrier function protecting the core material from the environment external to the microcapsule, but it may also act as a means of modulating the release of

core materials such as fragrance. Thus, a shell may be water soluble or water swellable and fragrance release may be actuated in response to exposure of the microcapsules to a moist environment. Similarly, if a shell is temperature sensitive, a microcapsule might release fragrance in response to elevated temperatures. Microcapsules may also release  
5 fragrance in response to shear forces applied to the surface of the microcapsules.

A preferred type of polymeric microparticle suitable for use in the invention is a polymeric core-shell microcapsule in which at least one generally spherical continuous shell of polymeric material surrounds a core containing the fragrance formulation (f2). The shell will typically comprise at most 20% by weight based on the total weight of the  
10 microcapsule. The fragrance formulation (f2) will typically comprise from about 10 to about 60% and preferably from about 20 to about 40% by weight based on the total weight of the microcapsule. The amount of fragrance (f2) may be measured by taking a slurry of the microcapsules, extracting into ethanol and measuring by liquid chromatography.  
15

Polymeric core-shell microcapsules for use in the invention may be prepared using methods known to those skilled in the art such as coacervation, interfacial polymerization, and polycondensation.

20 The process of coacervation typically involves encapsulation of a generally water-insoluble core material by the precipitation of colloidal material(s) onto the surface of droplets of the material. Coacervation may be simple e.g. using one colloid such as gelatin, or complex where two or possibly more colloids of opposite charge, such as gelatin and gum arabic or gelatin and carboxymethyl cellulose, are used under carefully  
25 controlled conditions of pH, temperature and concentration.

Interfacial polymerisation typically proceeds with the formation of a fine dispersion of oil droplets (the oil droplets containing the core material) in an aqueous continuous phase. The dispersed droplets form the core of the future microcapsule and the dimensions of  
30 the dispersed droplets directly determine the size of the subsequent microcapsules. Microcapsule shell-forming materials (monomers or oligomers) are contained in both the dispersed phase (oil droplets) and the aqueous continuous phase and they react together at the phase interface to build a polymeric wall around the oil droplets thereby to encapsulate the droplets and form core-shell microcapsules. An example of a core-shell

microcapsule produced by this method is a polyurea microcapsule with a shell formed by reaction of diisocyanates or polyisocyanates with diamines or polyamines.

Polycondensation involves forming a dispersion or emulsion of the core material in an aqueous solution of precondensate of polymeric materials under appropriate conditions of  
5 agitation to produce capsules of a desired size, and adjusting the reaction conditions to cause condensation of the precondensate by acid catalysis, resulting in the condensate separating from solution and surrounding the dispersed core material to produce a coherent film and the desired microcapsules. An example of a core-shell microcapsule produced by this method is an aminoplast microcapsule with a shell formed from the  
10 polycondensation product of melamine (2,4,6-triamino-1,3,5-triazine) or urea with formaldehyde. Suitable cross-linking agents (e.g. toluene diisocyanate, divinyl benzene, butanediol diacrylate) may also be used and secondary wall polymers may also be used as appropriate, e.g. anhydrides and their derivatives, particularly polymers and co-  
15 polymers of maleic anhydride.

One example of a preferred polymeric core-shell microcapsule for use in the invention is an aminoplast microcapsule with an aminoplast shell surrounding a core containing the fragrance formulation (f2). More preferably such an aminoplast shell is formed from the polycondensation product of melamine with formaldehyde.  
20

Polymeric microparticles suitable for use in the invention will generally have an average particle size between 100 nanometers and 50 microns. Particles larger than this are entering the visible range. Examples of particles in the sub-micron range include latexes and mini-emulsions with a typical size range of 100 to 600 nanometers. The preferred  
25 particle size range is in the micron range. Examples of particles in the micron range include polymeric core-shell microcapsules (such as those further described above) with a typical size range of 1 to 50 microns, preferably 5 to 30 microns. The average particle size can be determined by light scattering using a Malvern Mastersizer with the average particle size being taken as the median particle size D (0.5) value. The particle size  
30 distribution can be narrow, broad or multimodal. If necessary, the microcapsules as initially produced may be filtered or screened to produce a product of greater size uniformity.

Polymeric microparticles suitable for use in the invention may be provided with a deposition aid at the outer surface of the microparticle. Deposition aids serve to modify the properties of the exterior of the microparticle, for example to make the microparticle more substantive to a desired substrate. Desired substrates include cellulose (including cotton) and polyesters (including those employed in the manufacture of polyester fabrics).  
5 The deposition aid may suitably be provided at the outer surface of the microparticle by means of covalent bonding, entanglement or strong adsorption. Examples include polymeric core-shell microcapsules (such as those further described above) in which a deposition aid is attached to the outside of the shell, preferably by means of covalent  
10 bonding. While it is preferred that the deposition aid is attached directly to the outside of the shell, it may also be attached via a linking species.

Deposition aids for use in the invention may suitably be selected from polysaccharides having an affinity for cellulose. Such polysaccharides may be naturally occurring or  
15 synthetic and may have an intrinsic affinity for cellulose or may have been derivatised or otherwise modified to have an affinity for cellulose. Suitable polysaccharides have a 1-4 linked  $\beta$  glycan (generalised sugar) backbone structure with at least 4, and preferably at least 10 backbone residues which are  $\beta$ 1-4 linked, such as a glucan backbone (consisting of  $\beta$ 1-4 linked glucose residues), a mannan backbone (consisting of  $\beta$ 1-4 linked mannose  
20 residues) or a xylan backbone (consisting of  $\beta$ 1-4 linked xylose residues). Examples of such  $\beta$ 1-4 linked polysaccharides include xyloglucans, glucomannans, mannans, galactomannans,  $\beta$ (1-3),(1-4) glucan and the xylan family incorporating glucurono-, arabino- and glucuronoarabinoxylans. Preferred  $\beta$ 1-4 linked polysaccharides for use in the invention may be selected from xyloglucans of plant origin, such as pea xyloglucan  
25 and tamarind seed xyloglucan (TXG) (which has a  $\beta$ 1-4 linked glucan backbone with side chains of  $\alpha$ -D xylopyranose and  $\beta$ -D-galactopyranosyl-(1-2)- $\alpha$ -D-xylo-pyranose, both 1-6 linked to the backbone); and galactomannans of plant origin such as locust bean gum (LBG) (which has a mannan backbone of  $\beta$ 1-4 linked mannose residues, with single unit galactose side chains linked  $\alpha$ 1-6 to the backbone).

30

Also suitable are polysaccharides which may gain an affinity for cellulose upon hydrolysis, such as cellulose mono-acetate; or modified polysaccharides with an affinity for cellulose such as hydroxypropyl cellulose, hydroxypropyl methylcellulose, hydroxyethyl methylcellulose, hydroxypropyl guar, hydroxyethyl ethylcellulose and methylcellulose.



Deposition aids for use in the invention may also be selected from phthalate containing polymers having an affinity for polyester. Such phthalate containing polymers may have one or more nonionic hydrophilic segments comprising oxyalkylene groups (such as oxyethylene, polyoxyethylene, oxypropylene or polyoxypropylene groups), and one or more hydrophobic segments comprising terephthalate groups. Typically, the oxyalkylene groups will have a degree of polymerization of from 1 to about 400, preferably from 100 to about 350, more preferably from 200 to about 300. A suitable example of a phthalate containing polymer of this type is a copolymer having random blocks of ethylene terephthalate and polyethylene oxide terephthalate.

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

Deposition aids for use in the invention will generally have a weight average molecular weight ( $M_w$ ) in the range of from about 5 kDa to about 500 kDa, preferably from about 10 kDa to about 500 kDa and more preferably from about 20 kDa to about 300 kDa. One example of a particularly preferred polymeric core-shell microcapsule for use in the invention is an aminoplast microcapsule with a shell formed by the polycondensation of melamine with formaldehyde; surrounding a core containing the fragrance formulation (f2); in which a deposition aid is attached to the outside of the shell by means of covalent bonding. The preferred deposition aid is selected from  $\beta$ 1-4 linked polysaccharides, and in particular the xyloglucans of plant origin, as are further described above.

The present inventors have surprisingly observed that it is possible to reduce the total level of fragrance included in the composition of the invention without sacrificing the overall fragrance experience delivered to the consumer at key stages in the laundry process. A reduction in the total level of fragrance is advantageous for cost and environmental reasons.

Accordingly, the total amount of fragrance formulation (f1) and fragrance formulation (f2) in the composition of the invention suitably ranges from 0.5 to 1.4%, preferably from 0.5 to 1.2%, more preferably from 0.5 to 1% and most preferably from 0.6 to 0.9% (by weight based on the total weight of the composition).

The weight ratio of fragrance formulation (f1) to fragrance formulation (f2) in the composition of the invention preferably ranges from 60:40 to 45:55. Particularly good results have been obtained at a weight ratio of fragrance formulation (f1) to fragrance formulation (f2) of around 50:50.

5

The fragrance (f1) and fragrance (f2) are typically incorporated at different stages of formation of the composition of the invention. Typically, the discrete polymeric microparticles (e.g. microcapsules) entrapping fragrance formulation (f2) are added in the form of a slurry to a warmed base formulation comprising other components of the composition (such as surfactants and solvents). Fragrance (f1) is typically post-dosed later after the base formulation has cooled.

10

#### **FURTHER OPTIONAL INGREDIENTS**

A composition of the invention may contain further optional ingredients to enhance performance and/or consumer acceptability. Examples of such ingredients include foam boosting agents, preservatives (e.g. bactericides), polyelectrolytes, anti-shrinking agents, anti-wrinkle agents, anti-oxidants, sunscreens, anti-corrosion agents, drape imparting agents, anti-static agents, ironing aids, colorants, pearlisers and/or opacifiers, and shading dye. Each of these ingredients will be present in an amount effective to accomplish its purpose. Generally, these optional ingredients are included individually at an amount of up to 5% (by weight based on the total weight of the diluted composition) and so adjusted depending on the dilution ratio with water.

15

20

#### **DOMESTIC METHOD**

There is also provided a domestic method of treating a textile, the method comprising the step of: treating a textile with an aqueous solution of 0.5 to 20 g/L of the detergent composition as described herein, and optionally drying the textile.

25

Preferably, the domestic method the aqueous solution contains 0.1 to 1.0g/L of the surfactants in the composition.

30

Many of the ingredients used in embodiments of the invention may be obtained from so called black carbon sources or a more sustainable green source. The following provides a

list of alternative sources for several of these ingredients and how they can be made into raw materials described herein.

### SLES and PAS

5 SLES and other such alkali metal alkyl ether sulphate anionic surfactants are typically obtainable by sulphating alcohol ethoxylates. These alcohol ethoxylates are typically obtainable by ethoxylating linear alcohols. Similarly, primary alkyl sulphate surfactants (PAS) can be obtained from linear alcohols directly by sulphating the linear alcohol. Accordingly, forming the linear alcohol is a central step in obtaining both PAS and alkali-  
10 metal alkyl ether sulphate surfactants.

The linear alcohols which are suitable as an intermediate step in the manufacture of alcohol ethoxylates and therefore anionic surfactants such as sodium lauryl ether sulphate can be obtained from many different sustainable sources. These include:

15

#### Primary sugars

Primary sugars are obtained from cane sugar or sugar beet, etc., and may be fermented to form bioethanol. The bioethanol is then dehydrated to form bio-ethylene which then undergoes olefin metathesis to form alkenes. These alkenes are then processed into  
20 linear alcohols either by hydroformylation or oxidation.

An alternative process also using primary sugars to form linear alcohols can be used and where the primary sugar undergoes microbial conversion by algae to form triglycerides. These triglycerides are then hydrolysed to linear fatty acids and which are then reduced  
25 to form the linear alcohols.

#### Biomass

Biomass, for example forestry products, rice husks and straw to name a few may be processed into syngas by gasification. Through a *Fischer Tropsch* reaction these are  
30 processed into alkanes, which in turn are dehydrogenated to form olefins. These olefins may be processed in the same manner as the alkenes described above [primary sugars]. An alternative process turns the same biomass into polysaccharides by steam explosion which may be enzymatically degraded into secondary sugars. These secondary sugars are then fermented to form bioethanol which in turn is dehydrated to form bio-ethylene.

This bio-ethylene is then processed into linear alcohols as described above [primary sugars].

#### Waste Plastics

5 Waste plastic is pyrolyzed to form pyrolysed oils. This is then fractioned to form linear alkanes which are dehydrogenated to form alkenes. These alkenes are processed as described above [primary sugars].

10 Alternatively, the pyrolyzed oils are cracked to form ethylene which is then processed to form the required alkenes by olefin metathesis. These are then processed into linear alcohols as described above [primary sugars].

#### Municipal Solid Waste

15 MSW is turned into syngas by gasification. From syngas it may be processed as described above [primary sugars] or it may be turned into ethanol by enzymatic processes before being dehydrogenated into ethylene. The ethylene may then be turned into linear alcohols by the *Ziegler Process*.

20 The MSW may also be turned into pyrolysis oil by gasification and then fractioned to form alkanes. These alkanes are then dehydrogenated to form olefins and then linear alcohols.

#### Marine Carbon

25 There are various carbon sources from marine flora such as seaweed and kelp. From such marine flora the triglycerides can be separated from the source and which is then hydrolysed to form the fatty acids which are reduced to linear alcohols in the usual manner.

30 Alternatively, the raw material can be separated into polysaccharides which are enzymatically degraded to form secondary sugars. These may be fermented to form bio-ethanol and then processed as described above [Primary Sugars].

#### Waste Oils

Waste oils such as used cooking oil can be physically separated into the triglycerides which are split to form linear fatty acids and then linear alcohols as described above.

Alternatively, the used cooking oil may be subjected to the Neste Process whereby the oil is catalytically cracked to form bio-ethylene. This is then processed as described above.

#### Methane Capture

5 Methane capture methods capture methane from landfill sites or from fossil fuel production. The methane may be formed into syngas by gasification. The syngas may be processed as described above whereby the syngas is turned into methanol (*Fischer Tropsch* reaction) and then olefins before being turned into linear alcohols by hydroformylation oxidation.

10

Alternatively, the syngas may be turned into alkanes and then olefins by *Fischer Tropsch* and then dehydrogenation.

#### Carbon Capture

15 Carbon dioxide may be captured by any of a variety of processes which are all well known. The carbon dioxide may be turned into carbon monoxide by a reverse water gas shift reaction and which in turn may be turned into syngas using hydrogen gas in an electrolytic reaction. The syngas is then processed as described above and is either turned into methanol and/or alkanes before being reacted to form olefins.

20

Alternatively, the captured carbon dioxide is mixed with hydrogen gas before being enzymatically processed to form ethanol. This is a process which has been developed by Lanzatech. From here the ethanol is turned into ethylene and then processed into olefins and then linear alcohols as described above.

25

The above processes may also be used to obtain the C16/18 chains of the C16/18 alcohol ethoxylate and/or the C16/18 ether sulfates.

#### LAS

30 One of the other main surfactants commonly used in cleaning compositions, in particular laundry compositions is LAS (linear alkyl benzene sulphonate).

The key intermediate compound in the manufacture of LAS is the relevant alkene. These alkenes (olefins) may be produced by any of the methods described above and may be

formed from primary sugars, biomass, waste plastic, MSW, carbon capture, methane capture, marine carbon to name a few.

Whereas in the processed described above the olefin is processed to form linear alcohols  
 5 by hydroformylation and oxidation instead, the olefin is reacted with benzene and then  
 sulphonate to form the LAS.

### **EXAMPLES**

Methyl Ester of the following composition [ $<C_{16}$  2.9wt%;  $C_{16}$  25.8wt%;  $C_{18:0}$  7.9wt%;  
 10  $C_{18:1}$  53.9wt%;  $C_{18:2}$  8.8wt%;  $>C_{18}$  0.6wt%] was ethoxylated with a Ca catalyst to give  
 methyl ester ethoxylate with 10 mole average of ethoxylation (MEE 10EO).

The methyl ester ethoxylates surfactant were formulated into isotropic laundry liquid  
 detergents with cleaning polymer, enzymes, sequesterant, linear alkyl benzene sulfonate,  
 15 perfume, fluorescer and a  $C_{12-15}$  ether sulfate with 3 moles of ethoxylation based on  
 Neodol 25-3 alcohol and an ether sulfate comprising a mixture of  $C_{16}$  and  $C_{18}$ ,  
 predominantly  $C_{18}$ , with 6 moles of ethoxylation based on an oleyl 70/75 alcohol. The  
 formulation had the following composition in wt%.

	<b>C12-15 ether sulfate <i>comparative</i></b>	<b>C18 ether sulfate <i>inventive</i></b>
MonoPropylene Glycol	1.0	0.0
Linear alkyl benzene sulfonate	9.9	9.9
Methyl ester ethoxylate	7.5	7.5
ether sulfate	7.5	7.5
Cleaning Polymers	1.5	1.5
Enzymes	1.6	1.6
Sequesterant (Dequest 2010)	2.2	2.2
Sequesterant (Citric acid)	2.0	2.0
Fluorescer (Tinopal CBS-X)	0.2	0.2
Perfume	1.2	1.2
Preservative (Na Benzoate)	1.5	1.5
NaOH	2.4	2.4
water	remainder	remainder

20

The enzymes used were a mixture of Cellulase (Celluclean ®), Protease (Eivity ®), and amylase/mannanase (Medley ®) all ex Novozymes. Weights are given for pure actives,

except Tinopal CBS-X (ex BASF) and enzymes which are as supplied. The pH of the final formulation was 6.5.

5 Monopropylene glycol was required to form a clear isotropic liquid for the C12-15 ether sulfate/MEE formulation.

An isotropic C18 ether sulfate/MEE laundry liquid formulation may be formulated without the need for any monopropylene glycol, unlike the C12-15 ether sulfate/MEE formulation.

10 The viscosity of the formulations in cP were measured and are reported below:

Shear rate ( $s^{-1}$ )	C12-15 ether sulfate <i>comparative</i>	C18 ether sulfate <i>inventive</i>
2	130	148
21	130	148
106	130	148

15 The C18 ether sulfate formulation has a higher viscosity than the C12-15 based ether sulfate formulation.

**CLAIMS**

1. A laundry detergent composition comprising methyl ester ethoxylate surfactant (MEE) and an alkyl ether sulphate (AES), a proportion of which AES comprises C18, wherein the MEE comprises at least 10% wt. of the total MEE, MEE with C18.
2. A composition according to claim 1 wherein the AES comprises at least 10% wt. of the total AES of AES with C18.
3. A composition according to claim 1 or 2 wherein the methyl ester ethoxylate (MEE) comprises at least 5% by wt. total MEE, MEE with a mole average of from 8 to 13 EO groups.
4. A composition according to any preceding claim wherein the methyl ester ethoxylate (MEE) comprises at least 5% by wt. total MEE, MEE with a mole average of from 9 to 11 EO groups.
5. A composition according to any preceding claim wherein the methyl ester ethoxylate comprises monounsaturated C18 and wherein the weight proportion of monounsaturated C18 to other C18 components is at least 2.2.
6. Composition according to any preceding claim wherein the weight proportion of monounsaturated C18 to other C18 components is at least 2.9 to 7.0.
7. Composition according to any preceding claim comprising from 0.1 to 30% wt. of the composition methyl ester ethoxylate.
8. Composition according to any preceding claim comprising at least 50% wt. water.
9. Composition according to any preceding claim which is a liquid detergent composition.



10. Composition according to any preceding claim wherein the level of surfactant in the formulation is from 4 to 30wt%.
11. Composition according to any preceding claim having a pH of 5 to 10, more preferably 6 to 8, most preferably 6.1 to 7.0.
12. Composition according to any preceding claim comprising less than 0.2% wt. monopropylene glycol.
13. A domestic method of treating a textile, the method comprising the step of treating a textile with an aqueous solution of 0.5 to 20 g/L of the detergent composition of any one of claims 1 to 13, and optionally drying the textile.

**INTERNATIONAL SEARCH REPORT**

International application No  
**PCT/EP2022/060326**

**A. CLASSIFICATION OF SUBJECT MATTER**  
**INV. C11D1/83**  
**ADD. C11D1/29 C11D1/74**

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.
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<b>Y</b>	<b>col. 1 1.5-10, col. 2 1. 56-57, col. 3</b> <b>1.28-31 and col. 10 1.34;</b> <b>claim 1; example 1</b>	<b>2, 5, 6</b>
<b>Y</b>	<b>US 2007/111914 A1 (HSU FENG-LUNG G [US] ET</b> <b>AL) 17 May 2007 (2007-05-17)</b> <b>line 129 - line 133; figures 1-4</b>	<b>5, 6</b>
<b>Y</b>	<b>US 2014/187466 A1 (LIN BIN [US] ET AL)</b> <b>3 July 2014 (2014-07-03)</b> <b>paragraphs [0007], [0012] - [0018],</b> <b>[0050]; examples 1-3</b>	<b>5, 6</b>
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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
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- "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  
  
**13 July 2022**

Date of mailing of the international search report  
  
**21/07/2022**

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## INTERNATIONAL SEARCH REPORT

International application No  
PCT/EP2022/060326

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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A	World Health Org. ET AL: "STANDARD FOR NAMED VEGETABLE OILS: Codex Alimentarius", , 31 December 2019 (2019-12-31), XP055806497, Retrieved from the Internet: URL: <a href="http://www.fao.org/fao-who-codexalimentarius/sh-proxy/en/?lnk=1&amp;url=https%3A%2F%2Fworkspace.fao.org%2Fsites%2Fcodex%2FStandards%2FCXS+210-1999%2FCXS_210e.pdf">http://www.fao.org/fao-who-codexalimentarius/sh-proxy/en/?lnk=1&amp;url=https%3A%2F%2Fworkspace.fao.org%2Fsites%2Fcodex%2FStandards%2FCXS+210-1999%2FCXS_210e.pdf</a> [retrieved on 2021-05-21] page 5 - page 6  -----	1-13
Y	WO 2020/260040 A1 (UNILEVER PLC [GB]; UNILEVER NV [NL]; CONOPCO INC D/B/A UNILEVER [US]) 30 December 2020 (2020-12-30)	2
A	example 1  -----	1, 13

# INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

**PCT/EP2022/060326**

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