



(11) **EP 2 770 044 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
27.08.2014 Bulletin 2014/35

(51) Int Cl.:
C11D 17/00 (2006.01) **C11D 1/83** (2006.01)
C11D 1/75 (2006.01) **C11D 1/29** (2006.01)
C11D 1/22 (2006.01) **C11D 3/20** (2006.01)

(21) Application number: **13155883.5**

(22) Date of filing: **20.02.2013**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME

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Designated Contracting States:
AL AT BE BG CH CZ DE DK EE ES FI FR GR HR HU IS IT LI LT LU LV MC MK NL NO PL PT RO RS SE SI SK SM TR

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(54) **Lamellar gel with amine oxide**

(57) A lamellar gel shear thinning aqueous detergent liquid composition comprising from 5 to 25 wt%, preferably 8 to 18 wt%, of a detergent surfactant system, which surfactant system comprises:

- a) Alkyl benzene sulphonate,
b) (poly)ethoxylated alkyl sulphate with from 1 to 3 moles of ethoxylation,
The ratio of a) to b) being from 4:1 to 1:1,
c) at least 1 wt% amine oxide, and,

- d) optionally nonionic surfactant,
The ratios of (a+b) to c being at least 10:1 and (a+b) to d being at least 2:1 the liquid further comprising:
e) from 1 to 12 wt%, preferably from 4 to 9 wt% electrolyte,
f) water, and
g) at least 2 wt% performance additives selected from soluble benefit agents, insoluble benefit agents and mixtures thereof.

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DescriptionTECHNICAL FIELD

[0001] This invention relates to lamellar gel detergent liquids.

BACKGROUND

[0002] For hand wash detergent liquids with high cleaning power it can be useful to use linear alkylbenzenesulphonate (LAS) rich mixtures with alkylethoxy sulphate (AES), in particular the sodium salts of these detergent surfactants. To give the correct sensory properties for the liquids, they should ideally have a thick and possibly shear thinning viscosity. This Viscosity profile also enables them to suspend any solid particles that the formulator desires to include. One possible route to the desired rheology is to formulate the liquid so that it forms a stable lamellar gel. In practice this has proved difficult to do unless high electrolyte (citrate) levels are used. Stability is also compromised as the amount of ethoxylation of the AES drops from 3 to 1 and as the amount of total surfactant in the liquid drops below 20 wt%. The formulator would prefer to use AES with lower ethoxylation as it is less expensive and more widely available. Formulations with high levels of citrate or other electrolyte to generate the lamellar phase are less desirable because this electrolyte does not contribute significantly to the cleaning performance, so it is adding cost and chemicals for no consumer perceivable benefit. Such addition is also undesirable from an environmental perspective. The use of lower levels of surfactant system is also desirable from an environmental standpoint and the formulation space freed up by this reduction (and the possible loss of cleaning power) can be rebalanced by the inclusion of high weight efficiency performance additives. This approach to formulation of detergent liquids and information about suitable performance additives is described in WO09153184.

[0003] US2011220537 (P&G) relates to a similar problem. The solution adopted is to add an external structurant to the liquid. The external structurant is a specific pH tunable amido gellant. Because they are externally structured the liquids do not contain electrolyte at high enough levels to make them into internally structured lamellar gels. All the liquids exemplified are isotropic liquids with a gelled structuring premix of the amido compound added to thicken them as the pH is adjusted. These liquids are not stable lamellar gels and the cost and complexity of the special external structuring system and its pH sensitivity makes such a solution unsuited for many commercial detergent liquid applications, especially hand wash applications where near neutral pH is an advantage and formulation cost is a major issue.

[0004] It is desirable to solve the problem of rheology adjustment by use of an internally structured stable lamellar gel detergent liquid composition.

[0005] US6277803 (Colgate), discloses a series of examples of electrolyte gelled high active detergent liquids (35% AD) comprising a surfactant system of alkyl olefin sulphonate (AOS), LAS and amine oxide (AO). AES is absent in the examples. High active compositions form stable gels relatively easily.

[0006] US2011209291 (P&G), describes detergent liquids with an external structuring system. The comparative examples A and B omit the external structuring system. Comparative Example A uses a low level of amine oxide and an excess of AES over LAS. This should be an isotropic liquid although it might be an unstable lamellar gel if electrolyte were added. We have found that stable lamellar gels are very difficult to make when the LAS / AES ratio is less than 1:1. There is an excess of AES as in Comparative Example A.

[0007] US2005020467 (Colgate), discloses compositions that must comprise 10 to 20% of AES (claim 1). Only example 1 has this much AES. The mixed LAS system used in example 1 gives a total of 12.02, the AES level is 11.5. Thus this composition does have an excess of LAS over AES. The amount of the optional amine oxide in example 1 is 5%, which is high. There is no electrolyte present at a high enough level to make this into a lamellar gel. This is supported by the information that it could not suspend gelatin beads. The level of amine oxide is too high and the level of electrolyte too low to form a stable gel.

[0008] US6972278 (Unilever), relates to lamellar gel detergent liquids that are gelled by addition of fatty acid. The exemplified compositions have an excess of AES over LAS and no AO. Nonionic (NI) is typically present too. The presence of high levels of fatty acid suppresses foam generation which makes these liquids unsuitable for hand wash and top loading automatic applications.

[0009] US4615819 (Unilever), describes high active detergent liquids, some comprising LAS and AES, which are forced into a lamellar gel phase by adding high levels of urea as gelling agent. No amine oxide was used. Adding high levels of gelling agent adds to cost and makes it more difficult to include other useful ingredients into the compositions. There is also consumer resistance to use of urea.

[0010] US7297674 (Unilever), describes electrolyte gelled low active LAS / nonionic detergent liquids which have mono or polyethylene glycol dialkyl ether added to improve their clarity. The examples in this document do not comprise the AES that is desired for hand wash. It is suggested to be possible to add AES but there is no disclosure that this may cause problems for maintenance of stable lamellar gels and no suggestion to add any amine oxide to the compositions.

Furthermore the nonionic content would make the exemplified liquids unsuitable for hand wash where foam generation is desired.

[0011] US7022657 (Unilever), relates to detergent liquids that are gelled by addition of a fatty alcohol. Comparative composition D, without the fatty alcohol gelling agent, is isotropic. It has more AES than LAS and also contains a relatively high level of nonionic. Composition C is gelled by addition of the fatty alcohol. There is no suggestion to add amine oxide to these compositions. Fatty alcohols suppress foam and are undesirable in hand wash compositions.

[0012] US2004058840 (Unilever), makes a general disclosure of lamellar gels formed with LAS and AES. There is no suggestion to use amine oxide. No AES is used in the examples.

[0013] "Gel" as used herein means a shear thinning, lamellar gel, with a pouring viscosity in the range of from 100 to 5000 mPas (milli Pascal seconds), more preferably less than 3000 mPas, most preferably less than 1500 mPas, and which also has a critical shear stress higher than 10 Pa, more preferably higher than 15 Pa, most preferably higher than 20 Pa, but not exceeding 100 Pa.

[0014] The concept of "gel" in the art is frequently not well defined. The most common, loose definition, however, is that a gel is a thick liquid. Nevertheless, a thick liquid may be a Newtonian fluid, which does not change its viscosity with the change in flow condition, such as honey or syrup. This type of thick liquid is very difficult and messy to dispense. A different type of liquid gel is shear-thinning, i.e. it is thick at low shear condition (e.g. at rest) and thin at high flow rate condition.

[0015] Shear-thinning rheological properties can be measured with a viscometer or a sophisticated rheometer and the correct measurement spindle. The plot of viscosity vs. shear rate will reveal whether the sample is shear thinning or not.

[0016] As used herein, "pouring viscosity" means viscosity measured at a shear rate of 20 s^{-1} . It can be read off the plot of viscosity vs. shear rate.

[0017] The critical shear stress is the shear stress at which viscosity drops dramatically.

[0018] As used herein, "lamellar" means that liquid crystals within the gel have lipid layers (sheets). Lamellar structures can be detected by polarized light microscope. The majority of these lamellar structures remain in a mixture of sheet and vesicles. Stable lamellar phases are in fact the results of a mixed mesophase. This is where the lamellar phase is coexistent with another elongated micelle phase (isotropic).

[0019] As used herein, "lamellar gels" means gels that have lamellar phase structure, either alone or intermixed with isotropic phase (known as L1).

SUMMARY OF THE INVENTION

[0020] A lamellar gel shear thinning aqueous detergent liquid comprising from 5 to 25 wt%, preferably 8 to 18 wt%, of a detergent surfactant system, which surfactant system comprises:

- a) Alkyl benzene sulphonate,
- b) (poly)ethoxylated alkyl sulphate, preferably SLES 1 EO,

The ratio of a) to b) being from 4:1 to 1:1,

- c) at least 1 wt% amine oxide, and,

- d) optionally nonionic surfactant,

The ratios of (a+b) to c being at least 10:1 and (a+b) to d being at least 2:1, the liquid further comprising:

- e) from 1 to 12 wt%, preferably from 4 to 9 wt% electrolyte,

- f) water, and

- g) at least 2 wt% performance additives selected from soluble benefit agents, insoluble benefit agents and mixtures thereof.

[0021] Advantageously the performance additives are selected from the group comprising: enzymes, polymers, fluorescent whitening agents, shading dyes, encapsulated perfume, encapsulated fabric care materials.

[0022] Preferably the composition comprises less than 0.5 wt%, more preferably, zero nonionic surfactant.

[0023] Preferably the composition comprises less than 1 wt% soap/fatty acid.

[0024] The SLES 1 EO is the more difficult to make into a stable gel. The invention is particularly useful to allow the lower ethoxylation of SLES 1 EO and SLES 2EO to be utilised in the compositions. The invention is particularly useful for compositions which comprise SLES 1 EO.

[0025] Addition of the amine oxide provides stable LAS rich relatively low (10% and 15%) active detergent (AD) lamellar gels using as little as 2 wt% citrate as lamellar generator electrolyte.

[0026] The resulting liquid compositions are stable, thick and have rheology that can suspend microcapsules, such as perfume encapsulates.

[0027] The alkyl benzene sulphonate is preferably linear alkylbenzene sulphonate.

DETAILED DESCRIPTION OF THE INVENTION

Surfactants

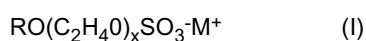
5 **[0028]** Surfactants assist in removing soil from the textile materials and also assist in maintaining removed soil in solution or suspension in the wash liquor. Anionic or blends of anionic and nonionic surfactants are a preferred feature of the compositions. The amount of anionic surfactant is preferably at least 5 wt%. Preferably, the anionic surfactant forms the majority of the surfactant.

10 *Anionic*

[0029] The composition comprises an alkylbenzene sulphonates, preferably a linear alkylbenzene sulphonate having an alkyl chain length of C₈-C₁₅. The counter ion for anionic surfactants is generally an alkali metal, typically sodium, although other counter-ions for example MEA, TEA or ammonium can be used.

15 **[0030]** Suitable linear alkyl benzene sulphonate surfactants include Detal LAS with an alkyl chain length of from 8 to 15, more preferably 12 to 14.

[0031] The composition further comprises an alkyl polyethoxylate sulphate anionic surfactant of the formula (I):



20 where R is an alkyl chain having from 10 to 22 carbon atoms, saturated or unsaturated, M is a cation which makes the compound water-soluble, especially an alkali metal, ammonium or substituted ammonium cation, and x averages from 1 to 15.

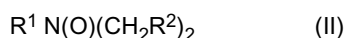
25 **[0032]** Preferably R is an alkyl chain having from 12 to 16 carbon atoms, M is Sodium and x averages from 1 to 3, preferably x is 1; This is the anionic surfactant sodium lauryl ether sulphate (SLES). It is the sodium salt of lauryl ether sulphonic acid in which the predominantly C12 lauryl alkyl group has been ethoxylated with an average of 1 mole of ethylene oxide per mole.

30 *Nonionic*

[0033] If nonionic surfactants are used then suitable examples include primary and secondary alcohol ethoxylates, especially C₈-C₂₀ aliphatic alcohol ethoxylated with an average of from 1 to 20 moles of ethylene oxide per mole of alcohol, and more especially the C₁₀-C₁₅ primary and secondary aliphatic alcohols ethoxylated with an average of from 1 to 10 moles of ethylene oxide per mole of alcohol. Non-ethoxylated nonionic surfactants also include alkyl polyglycosides, glycerol monoethers and polyhydroxy amides (glucamide). Mixtures of nonionic surfactant may be used. When included therein the composition contains from 0.2 wt% to 10 wt%, preferably less than 1 wt% nonionic.

Amine Oxide

40 **[0034]** The compositions comprise at least 1 wt% and preferably no more than 10 wt% of an amine oxide of the formula (II):



45 In which R¹ is a long chain moiety each CH₂R² are short chain moieties. R² is preferably selected from hydrogen, methyl and -CH₂OH. In general R¹ is a primary or branched hydrocarbyl moiety which can be saturated or unsaturated, preferably, R¹ is a primary alkyl moiety. R¹ is a hydrocarbyl moiety having chain length of from about 8 to about 18.

[0035] Preferred amine oxides have R¹ is C₈-C₁₈ alkyl, and R² is H. These amine oxides are illustrated by C₁₂₋₁₄ alkyldimethyl amine oxide, hexadecyl dimethylamine oxide, octadecylamine oxide.

50 **[0036]** A preferred amine oxide material is Lauryl dimethylamine oxide, also known as dodecyldimethylamine oxide or DDAO. Such an amine oxide material is commercially available from Huntsman under the trade name Empigen® OB.

[0037] Amine oxides suitable for use herein are also available from Akzo Chemie and Ethyl Corp. See McCutcheon's compilation and Kirk-Othmer review article for alternate amine oxide manufacturers.

55 **[0038]** Whereas in certain of the preferred embodiments R² is H, it is possible to have R² slightly larger than H. Specifically, R² may be CH₂OH, for example: hexadecylbis(2-hydroxyethyl)amine oxide, tallowbis(2-hydroxyethyl)amine oxide, stearylbis(2-hydroxyethyl)amine oxide and oleylbis(2-hydroxyethyl)amine oxide.

[0039] Preferred amine oxides have the formula (IV):



where R¹ is C₁₂₋₁₆ alkyl, preferably C₁₂₋₁₄ alkyl; Me is a methyl group.

Additional surfactants

[0040] Other surfactants than the preferred LAS, SLES, and amine oxide may be added to the mixture of deterative surfactants. However cationic surfactants are preferably substantially absent.

[0041] Some zwitterionic surfactant, for example carbobetaine, may be present. A preferred zwitterionic material is a carbobetaine available from Huntsman under the name Empigen® BB. Betaines improve particulate soil detergency in the compositions.

[0042] Although less preferred, some alkyl sulphate surfactant (PAS) may be used, especially the non-ethoxylated C₁₂₋₁₅ primary and secondary alkyl sulphates. A particularly preferred material, commercially available from BASF, is Sulfopon 1214G.

Electrolyte

[0043] The preferred electrolyte is sodium citrate, especially trisodium citrate. Other suitable electrolytes include: Sodium Formate, Sodium acetate, Potassium acetate, Sodium thiosulphate and Sodium sulphite.

Performance additives

EPEI

[0044] A particularly preferred class of polymer for use in the composition is polyethylene imine, preferably modified polyethylene imine. Polyethylene imines are materials composed of ethylene imine units -CH₂CH₂NH- and, where branched, the hydrogen on the nitrogen is replaced by another chain of ethylene imine units. These polyethyleneimines can be prepared, for example, by polymerizing ethyleneimine in the presence of a catalyst for example carbon dioxide, sodium bisulphite, sulphuric acid, hydrogen peroxide, hydrochloric acid, acetic acid, and the like. Specific methods for preparing these polyamine backbones are disclosed in U.S. Pat. No. 2,182,306, Ulrich et al., issued Dec. 5, 1939; U.S. Pat. No. 3,033,746, Mayle et al., issued May 8, 1962; U.S. Pat. No. 2,208,095, Esselmann et al., issued Jul. 16, 1940; U.S. Pat. No. 2,806,839, Crowther, issued Sep. 17, 1957; and U.S. Pat. No. 2,553,696, Wilson, issued May 21, 1951.

[0045] Preferably, the EPEI comprises a polyethyleneimine backbone of about 300 to about 10000 weight average molecular weight; wherein the modification of the polyethyleneimine backbone is intended to leave the polymer without quaternisation. Such nonionic EPEI may be represented as PEI(X)YEO where X represents the molecular weight of the unmodified PEI and Y represents the average moles of ethoxylation per nitrogen atom in the polyethyleneimine backbone. The ethoxylation may range from 9 to 40 ethoxy moieties per modification, preferably it is in the range of 16 to 26, most preferably 18 to 22.

[0046] The polyethyleneimine polymer is present in the composition preferably at a level of between 0.01 and 25 wt%, but more preferably at a level of at least 2 wt% and/or less than 9.5 wt%, most preferably from 3 to 9 wt% and with a ratio of non-soap surfactant to EPEI of from 2:1 to 7:1, preferably from 3:1 to 6:1, or even to 5:1.

Polyester soil release polymer

[0047] The compositions may include 0.5 wt% or more of a soil release polymer which is substantive to polyester fabric. Such polymers typically have a fabric substantive midblock formed from propylene terephthalate repeat units and one or two end blocks of capped polyalkylene oxide, typically PEG 750 to 2000 with methyl end capping.

Other polymers

[0048] In addition to a soil release polymer there may be used dye transfer inhibition polymers, anti redeposition polymers and cotton soil release polymers, especially those based on modified cellulosic materials.

Enzymes

[0049] It is preferable that at least one or more enzymes may be present in the compositions. Preferably at least two, more preferably at least three different classes of enzymes are used in combination. Lipase is a particularly preferred enzyme. The composition preferably contains from about 5 to about 20000 LU/g of a lipase.

[0050] Protease is also preferably present. Suitable proteases include those of animal, vegetable or microbial origin. Microbial origin is preferred.

[0051] Suitable amylases (alpha and/or beta) include those of bacterial or fungal origin. Chemically modified or protein engineered mutants are included.

5 Suitable cellulases include those of bacterial or fungal origin. Chemically modified or protein engineered mutants are included.

[0052] Pectate lyases (also called polygalacturonate lyases) may be included. Examples of pectate lyases include pectate lyases that have been cloned from different bacterial genera for example *Erwinia*, *Pseudomonas*, *Klebsiella* and *Xanthomonas*, as well as from *Bacillus subtilis* and *Bacillus sp.*

10 **[0053]** Examples of suitable mannanases (EC 3.2.1.78) include mannanases of bacterial and fungal origin. In a specific embodiment the mannanase is derived from a strain of the filamentous fungus genus *Aspergillus*, preferably *Aspergillus niger* or *Aspergillus aculeatus*.

[0054] The enzyme and any perfume/fragrance or pro-fragrance present may show some interaction and should be chosen such that this interaction is not negative. Some negative interactions may be avoided by encapsulation of one or other of enzyme and pro-fragrance and/or other segregation within the product.

Enzyme Stabilizers

20 **[0055]** Any enzyme present in the composition may be stabilized using conventional stabilizing agents, e.g., a polyol for example propylene glycol or glycerol, a sugar or sugar alcohol, lactic acid, boric acid, or a boric acid derivative, e.g., an aromatic borate ester, or a phenyl boronic acid derivative for example 4-formylphenyl boronic acid, and the composition may be formulated as described in e.g. WO 92/19709 and WO 92/19708.

Lignin compounds

25 **[0056]** When a lipase enzyme is included a lignin compound may be used in the composition in an amount that can be optimised by trial and error. Lignin is a component of all vascular plants, found mostly between cellular structures but also within the cells and in the cell walls.

30 **[0057]** Preferably the lignin compound comprises a lignin polymer and more preferably it is a modified lignin polymer. A modified lignin polymer as used herein is lignin that has been subjected to a chemical reaction to attach chemical moieties to the lignin covalently. The attached chemical moieties are preferably randomly substituted.

Fluorescent Agents

35 **[0058]** It may be advantageous to include fluorescer in the compositions. Usually, these fluorescent agents are supplied and used in the form of their alkali metal salts, for example, the sodium salts. The total amount of the fluorescent agent or agents used in the composition is generally from 0.005 to 2 wt %, more preferably 0.01 to 0.5 wt %.

40 **[0059]** Preferred classes of fluorescer are: Di-styryl biphenyl compounds, e.g. Tinopal (Trade Mark) CBS-X, Di-amine stilbene di-sulphonic acid compounds, e.g. Tinopal DMS pure Xtra, Tinopal 5BMGX, and Blankophor (Trade Mark) HRH, and Pyrazoline compounds, e.g. Blankophor SN.

[0060] Preferred fluorescent agents are: sodium 2 (4-styryl-3-sulfophenyl)-2H-naphthol[1,2-d]triazole, disodium 4,4'-bis{[(4-anilino-6-(N methyl-N-2 hydroxyethyl) amino 1,3,5-triazin-2-yl)]amino}stilbene-2-2' disulfonate, disodium 4,4'-bis{[(4-anilino-6-morpholino-1,3,5-triazin-2-yl)]amino} stilbene-2-2' disulfonate, and disodium 4,4'-bis(2-sulfosilyl)biphenyl.

Bleach Catalysts

45 **[0061]** Compositions may comprise a weight efficient bleach system. Such systems typically do not utilise the conventional percarbonate and bleach activator approach. An air bleach catalyst system is preferred. Suitable complexes and organic molecule (ligand) precursors for forming complexes are available to the skilled worker, for example, from: WO 98/39098; WO 98/39406, WO 97/48787, WO 00/29537; WO 00/52124, and WO00/60045, incorporated by reference. An example of a preferred catalyst is a transition metal complex of MeN4Py ligand (N,N-bis(pyridin-2-yl-methyl)-1-,1-bis(pyridin-2-yl)-1-aminoethane). Suitable bispidon catalyst materials and their action are described in WO02/48301. The bleach catalyst may be encapsulated to reduce interaction with other components of the liquid during storage.

55 **[0062]** Photobleaches may also be employed. A "photobleach" is any chemical species that forms a reactive bleaching species on exposure to sunlight, and preferably is not permanently consumed in the reaction. Preferred photo-bleaches include singlet oxygen photo-bleaches and radical photo-bleaches. Suitable singlet oxygen photo-bleaches may be selected from, water soluble phthalocyanine compounds, particularly metallated phthalocyanine compounds where the metal is Zn or Al-Z1 where Z1 is a halide, sulphate, nitrate, carboxylate, alkanolate or hydroxyl ion. Preferably the

phthalocyanin has 1-4 SO₃X groups covalently bonded to it where X is an alkali metal or ammonium ion. Such compounds are described in WO2005/014769 (Ciba).

[0063] When present, the bleach catalyst is typically incorporated at a level of about 0.0001 to about 10 wt%, preferably about 0.001 to about 5 wt%.

Perfume

[0064] A free oil perfume is preferably used. In addition, a particularly preferred option is to use an encapsulated perfume.

[0065] It is even more preferable that the perfume is not only encapsulated but also that the encapsulated perfume is provided with a deposition aid to increase the efficiency of perfume deposition and retention on fabrics. The deposition aid is preferably attached to the encapsulate by means of a covalent bond, entanglement or strong adsorption, preferably by a covalent bond or entanglement.

Further Optional performance additives

[0066] The compositions may contain one or more other ingredients. Such ingredients include viscosity modifiers, foam boosting agents, preservatives (e.g. bactericides), pH buffering agents, polyelectrolytes, anti-shrinking agents, anti-wrinkle agents, anti-oxidants, sunscreens, anti-corrosion agents, drape imparting agents, anti-static agents and ironing aids. The compositions may further comprise colorants, pearlisers and/or opacifiers, and shading dye.

Shading dyes

[0067] 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. Examples of shading dyes are alkoxylated thiophene dyes, acid violet 50, direct violet 35, direct violet 99, direct violet 9, solvent violet 13, disperse violet 28, disperse blue 165.

[0068] Shading dye can be used in the absence of fluoescer, but it is especially preferred to use a shading dye in combination with a fluoescer, for example in order to reduce yellowing due to chemical changes in adsorbed fluoescer.

Builders and sequestrants

[0069] The detergent compositions may also optionally contain further organic detergent builder or sequestant material. Examples include the alkali metal, succinates, malonates, carboxymethyl succinates, carboxylates, polycarboxylates and polyacetyl carboxylates. Specific examples include sodium, potassium and lithium salts of oxydisuccinic acid, mellitic acid, benzene and polycarboxylic acids. Other examples are DEQUEST[™], organic phosphonate type sequestering agents sold by Monsanto and alkanehydroxy phosphonates.

[0070] 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[™].

[0071] If utilized, the further organic builder materials may comprise from about 0.5% to 20 wt%, preferably from 1 wt% to 10 wt%, of the composition. The preferred further builder level is less than 10 wt% and preferably less than 5 wt% of the composition. A preferred sequestant 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® 2066 (Diethylenetriamine penta(methylene phosphonic acid or Heptasodium DTPMP).

Buffers

[0072] The presence of some buffer is preferred for pH control; preferred buffers are MEA, and TEA. If present they are preferably used in the composition at levels of from 1 to 15 wt%.

Visual Cues

[0073] The compositions may comprise visual cues of solid material that is not dissolved in the composition. Preferred visual cues are lamellar cues formed from polymer film and possibly comprising functional ingredients that may not be as stable if exposed to the alkaline liquid. Enzymes and bleach catalysts are examples of such ingredients. Also perfume, particularly microencapsulated perfume.

Packaging and dosing

[0074] The liquids may be packaged as unit doses in polymeric film adapted to be insoluble until added to the wash water. More preferred the liquids are supplied in multiuse plastics packs with a top or bottom closure. A dosing measure may be supplied with the pack either as a part of the cap or as an integrated system.

[0075] The invention will now be further described with reference to the following nonlimiting examples.

EXAMPLES

[0076] 3 LAS/SLES ratios were tested. Each ratio was repeated with 3 types of SLES as the AES (SLES 1 EO, 2EO, 3EO). After mixing the surfactants the sample was left for one day to equilibrate. To complete the matrix an amount of electrolyte was then added to the sample in an amount from zero to 15 wt% as indicated. The resulting compositions were left to equilibrate for a second day. The Electrolyte used was in all cases Trisodium Citrate (TSC). The levels of electrolyte added were, 0, 2, 4, 6, 8, 10, 12.5, and 15 wt%. We always used the same order of addition.

[0077] Each composition was then stability tested for one week (Freeze Thaw: 21°C down to -15°C).

[0078] In Tables 1 to 12:

- AD = active detergent, surfactant weight percent of composition.
- ISO = isotropic liquid
- ULG = Unstable lamellar gel
- SLG = Stable lamellar gel

[0079] Compositions without any AO lamellar gel stabiliser are comparative (Tables 1, 3, 5, 7, 9 and 11).

[0080] Compositions with AO are detailed in Tables 2, 4, 6, 8, 10 and 12.

The amount of EO in the SLES seems to be important for the formation of lamellar liquids (3EO>2EO>1 EO). Without AO no composition was stable at 10 wt% AD with 1 EO. In the absence of AO, high levels of citrate were needed to stabilise the lamellar gels using 2EO and 3EO. This level of citrate is undesirable for commercial products.

[0081] Even at 15 wt% AD, it remained impossible to form stable lamellar gels without AO at lower electrolyte concentrations. The stable lamellar gel compositions are all found in the LAS rich ratios.

[0082] At 15 wt% AD there are 3 compositions that are stable for SLES 2EO and six for SLES 3EO. As with the 10 wt% AD without AO compositions, these stable compositions require high (10+ wt%) electrolyte concentrations. This level of electrolyte is undesirable for a commercial product because it interferes with other salt based components that the formulator wishes to include.

[0083] Again it is impossible to form a stable lamellar gel with SLES 1 EO in these comparative compositions. However, the increase in active level to 15 wt% can help to drive lamellar formation, especially for SLES 3EO.

[0084] Incorporation of amine oxide (1.5 wt% Empigen® OB) into the compositions improves the lamellar gel formation. This is especially useful at lower electrolyte concentration and for compositions using the SLES 1 EO. The greatest benefit occurs for the lower surfactant level of 10 wt% (anionic).

[0085] With amine oxide present there are opportunities to generate stable lamellar gels that survive freeze thaw with every type of SLES (1 EO to 3EO).

[0086] At 15 wt% AD with 1.5 wt% Empigen® OB, lamellar gel formation is highly boosted compared to the formulation without amine oxide. The stable gels are easier to form with increasing degree of ethoxylation of the SLES.

[0087] The formation of stable lamellar gels becomes even easier as the AD is further increased to 20 wt%. When it gets as high as 25 wt% the benefit of inclusion of AO is minimal because the higher active levels already provide for stable lamellar gel formation at these surfactant ratios.

Table 1 - LAS /SLES 1 EO 10 wt% AD (Comparative)

LAS/SLES ratio	Wt% Trisodium citrate added							
	0	2	4	6	8	10	12.5	15
7 / 3	ISO	ISO	ISO	ISO	ULG	ULG	ULG	ULG
6 / 4	ISO	ISO	ISO	ISO	ISO	ULG	ULG	ULG
5 / 5	ISO	ISO	ISO	ISO	ISO	ISO	ISO	ISO

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Table 2 - LAS /SLES 1 EO 10 wt% AD + 1.5 wt% AO

LAS/SLES ratio	Wt% Trisodium citrate added							
	0	2	4	6	8	10	12.5	15
7 / 3	ULG	ULG	ULG	SLG	SLG	SLG	SLG	ULG
6 / 4	ULG	SLG	ULG	ULG	SLG	SLG	SLG	SLG
5 / 5	ISO	ULG	ULG	ULG	ULG	ULG	ULG	SLG

Table 3 - LAS /SLES 2 EO 10 wt% AD (Comparative)

LAS/SLES ratio	Wt% Trisodium citrate added							
	0	2	4	6	8	10	12.5	15
7 / 3	ISO	ISO	ISO	ISO	ULG	ULG	ULG	SLG
6 / 4	ISO	ISO	ISO	ISO	ISO	ULG	ULG	SLG
5 / 5	ISO	ISO	ISO	ISO	ISO	ISO	ULG	ULG

Table 4 - LAS /SLES 2 EO 10 wt% AD + 1.5 wt% AO

LAS/SLES ratio	Wt% Trisodium citrate added							
	0	2	4	6	8	10	12.5	15
7 / 3	ULG	SLG	SLG	SLG	SLG	SLG	SLG	SLG
6 / 4	ULG	SLG	ULG	ULG	SLG	SLG	SLG	ULG
5 / 5	ISO	ULG	ULG	ULG	ULG	ULG	SLG	SLG

Table 5 - LAS /SLES 3 EO 10 wt% AD (Comparative)

LAS/SLES ratio	Wt% Trisodium citrate added							
	0	2	4	6	8	10	12.5	15
7 / 3	ISO	ISO	ISO	ULG	ULG	ULG	SLG	SLG
6 / 4	ISO	ISO	ISO	ULG	ULG	ULG	SLG	SLG
5 / 5	ISO	ISO	ISO	ISO	ULG	ULG	ULG	SLG

Table 6 - LAS /SLES 3 EO 10 wt% AD + 1.5 wt% AO

LAS/SLES ratio	Wt% Trisodium citrate added							
	0	2	4	6	8	10	12.5	15
7 / 3	ULG	SLG	SLG	SLG	SLG	SLG	SLG	SLG
6 / 4	SLG	SLG	SLG	SLG	SLG	SLG	SLG	SLG
5 / 5	ULG	SLG	ULG	ULG	SLG	SLG	SLG	SLG

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Table 7 - LAS /SLES 1 EO 15 wt% AD (Comparative)

LAS/SLES ratio	Wt% Trisodium citrate added							
	0	2	4	6	8	10	12.5	15
7 / 3	ISO	ISO	ISO	ULG	ULG	ULG	ULG	ULG
6 / 4	ISO	ISO	ISO	ISO	ULG	ULG	ULG	ULG
5 / 5	ISO	ISO	ISO	ISO	ISO	ULG	ULG	ULG

Table 8 - LAS /SLES 1 EO 15 wt% AD + 1.5 wt% AO

LAS/SLES ratio	Wt% Trisodium citrate added							
	0	2	4	6	8	10	12.5	15
7 / 3	SLG	ULG	ULG	SLG	SLG	ULG	ULG	ULG
6 / 4	ULG	ULG	ULG	SLG	SLG	SLG	SLG	SLG
5 / 5	ULG	ULG	ULG	ULG	ULG	SLG	SLG	SLG

Table 9 - LAS /SLES 2 EO 15 wt% AD (Comparative)

LAS/SLES ratio	Wt% Trisodium citrate added							
	0	2	4	6	8	10	12.5	15
7 / 3	ISO	ISO	ISO	ULG	ULG	ULG	SLG	SLG
6 / 4	ISO	ISO	ISO	ISO	ULG	ULG	ULG	SLG
5 / 5	ISO	ISO	ISO	ISO	ISO	ULG	ULG	ULG

Table 10 - LAS /SLES 2 EO 15 wt% AD + 1.5 wt% AO

LAS/SLES ratio	Wt% Trisodium citrate added							
	0	2	4	6	8	10	12.5	15
7 / 3	ULG	ULG	SLG	SLG	SLG	SLG	SLG	SLG
6 / 4	SLG	ULG	ULG	ULG	SLG	SLG	SLG	SLG
5 / 5	ISO	ULG	ULG	ULG	ULG	ULG	SLG	SLG

Table 11 - LAS /SLES 3 EO 15 wt% AD (Comparative)

LAS/SLES ratio	Wt% Trisodium citrate added							
	0	2	4	6	8	10	12.5	15
7 / 3	ISO	ISO	ULG	ULG	ULG	SLG	SLG	SLG
6 / 4	ISO	ISO	ULG	ULG	ULG	ULG	SLG	SLG
5 / 5	ISO	ISO	ISO	ISO	ULG	ULG	ULG	SLG

Table 12 - LAS /SLES 3 EO 15 wt% AD + 1.5 wt% AO

LAS/SLES ratio	Wt% Trisodium citrate added							
	0	2	4	6	8	10	12.5	15
7 / 3	ULG	ULG	SLG	SLG	SLG	SLG	SLG	SLG
6 / 4	ULG	ULG	ULG	SLG	SLG	SLG	SLG	SLG
5 / 5	ISO	ULG	ULG	ULG	ULG	SLG	SLG	SLG

Table 13 - Lamellar gel detergent compositions

<u>Ingredient</u>	<u>Comp A</u>	<u>Comp B</u>	<u>Comp C</u>
LAS	9	7	8.75
NI	0	0	0
SLES 1 EO	6	0	3.75
SLES 2 EO	0	3	0
Amine Oxide	1.5	1.5	1.5
Tri-sodium citrate	9	7.41	5.66
Encap perfume	0.3	0.3	0.3
Free oil perfume	1	1	1
Enzymes	0.1	0.1	0.1
Shading dye	0.01	0.01	0.01
TEA	2	2	2
NaOH	0.8	0.55	0.77
Dequest 2066	0.34	0.34	0.34
Proxel GXL	0.01	0.01	0.01
Balance water	Up to 100%	Up to 100%	Up to 100%

[0088] To show that the compositions were stable lamellar gels their viscosity was measured after storage. The results are given in Table 14.

Table 14

Composition	Yield stress (Pa)	Viscosity @ 1s⁻¹ Pa s	Viscosity @ 21 s⁻¹ Pa s	Viscosity @ 106s⁻¹ Pa s
Comp A	6.78	15.786	1.211	0.367
Comp B	0.172	0.443	0.099	0.054
Comp C	3.99	5.545	0.523	0.192

Claims

1. A lamellar gel shear thinning aqueous detergent liquid composition comprising from 5 to 25 wt%, preferably 8 to 18 wt%, of a detergent surfactant system, which surfactant system comprises:

- a) Alkyl benzene sulphonate,
- b) (poly)ethoxylated alkyl sulphate with from 1 to 3 moles of ethoxylation,
The ratio of a) to b) being from 4:1 to 1:1,
- c) at least 1 wt% amine oxide, and,
- d) optionally nonionic surfactant,

The ratios of (a+b) to c being at least 10:1 and (a+b) to d being at least 2:1 the liquid further comprising:
e) from 1 to 12 wt%, preferably from 4 to 9 wt% electrolyte,
f) water, and

g) at least 2 wt% performance additives selected from soluble benefit agents, insoluble benefit agents and mixtures thereof.

2. A composition according to claim 1 which comprises less than 0.5 wt%, preferably zero nonionic surfactant.
3. A composition according to any preceding claim which comprises less than 1 wt% soap/fatty acid.
4. A composition according to any preceding claim wherein the polyethoxylated alkyl sulphate comprises SLES 1 EO and / or SLES 2EO.
5. A composition according to any preceding claim wherein the polyethoxylated alkyl sulphate comprises SLES 1 EO.
6. A composition according to any preceding claim wherein the alkylbenzene sulphonate comprises linear alkylbenzene sulphonate.
7. A composition according to any preceding claim wherein the electrolyte comprises trisodium citrate.
8. A composition according to any preceding claim in which the performance additives are selected from the group comprising: enzymes, polymers, fluorescent whitening agents, shading dyes, encapsulated perfume, encapsulated fabric care materials.
9. A composition according to any preceding claim in which the performance additives are selected from the group comprising: enzymes, polymers, fluorescent whitening agents and shading dyes.
10. A composition according to any preceding claim comprising suspended visual cues.



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