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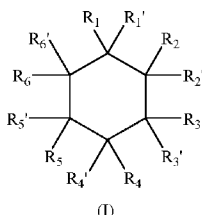
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(54) Title: LIQUID DETERGENT COMPOSITION



(57) Abstract: A liquid detergent composition comprising a surfactant system, the surfactant system comprising an anionic surfactant and a primary co-surfactant selected from the group consisting of amphoteric surfactant, zwitterionic surfactant and mixtures thereof wherein the anionic surfactant and the primary co-surfactant are in a weight ratio of less than 2.5:1 and wherein the composition further comprises a cyclic diamine of Formula(I): wherein two of the Rs, are selected from the group consisting of NH₂, (C₁-C₄)NH₂ and mixtures thereof and the remaining Rs are independently selected from H, linear or branched alkyl or alkenyl having from 1 to 10 carbon atoms.



LIQUID DETERGENT COMPOSITION

FIELD OF THE INVENTION

The present invention relates to a liquid detergent composition which provides improved grease
5 removal from hard surfaces including plastic and improved rinse feel.

BACKGROUND OF THE INVENTION

The detergent formulator is constantly aiming to improve the performance of detergent
compositions. One of the biggest challenges encountered in hard surface cleaning is the removal
10 of greasy soils, in particular the removal of greasy soils from dishware including hydrophobic
items such as plastic.

In manual dishwashing, the challenge is not only to remove the grease from hydrophobic items
but also to provide a good feeling during the rinse. Sometimes items can feel greasy or slippery
15 during the rinse and this is disliked by users.

Accordingly, there is a need for a liquid detergent composition that provides good grease
removal from dishware and at the same time does leave dishware free from slippery feeling
during rinse.

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SUMMARY OF THE INVENTION

The present invention addresses this need by providing a liquid detergent composition
comprising a specific surfactant system and a specific cyclic diamine. The detergent composition
is preferably a hand dishwashing detergent composition. The surfactant system comprises an
25 anionic surfactant and a primary co-surfactant in a specific weight ratio and optionally but
preferably a secondary co-surfactant. The primary co-surfactant is selected from the group
consisting of amphoteric surfactant, zwitterionic surfactant and mixtures thereof. The weight
ratio of anionic surfactant to primary co-surfactant is less than about 2.5:1, preferably more than
about 1:1.

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One advantage of the present invention is that it does not provide slippery feeling on washed
items and provide very efficient grease removal. Specially preferred anionic surfactant to

primary co-surfactant weight ratio, in terms of grease removal and lack of slippery feeling, is a ratio of from 2:1 to 1:1.

Preferred cyclic diamines for use herein include 1,3-bis (aminomethyl) cyclohexane (1,3-BAC),
5 2-methylcyclohexane-1,3-diamine, 4-methylcyclohexane-1,3-diamine and mixtures thereof. Compositions comprising 1,3-BAC, 2-methylcyclohexane-1,3-diamine, 4-methylcyclohexane-1,3-diamine and mixtures thereof, provide very good grease removal from dishware and the dishware does not feel slippery during rinse.

10 The anionic surfactant can be any anionic cleaning surfactant, preferably the anionic surfactant comprises a sulphate anionic surfactant, more preferably an alkyl sulphate and/or alkoxyated sulfate anionic surfactant, preferably an alkyl alkoxyated anionic surfactant having an average alkoxylation degree of from about 0.2 to about 3, preferably from about 0.2 to about 2, most preferably from about 0.2 to about 1.0. Also preferred are branched anionic surfactants having a
15 weight average level of branching of from about 5% to about 40%, more preferably alkyl alkoxyated anionic surfactants having a weight average level of branching of from about 5% to about 40%. Especially preferred anionic surfactant for use herein is an alkyl alkoxyated anionic surfactant having an average alkoxylation degree of from about 0.2 to about 1 and a weight average level of branching of from about 5% to about 40%.

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Preferably the composition of the invention comprises from about 10% to about 40%, preferably from about 15% to about 35%, more preferably from about 18% to about 32% by weight of the composition of the surfactant system. Preferably the composition of the invention comprises from about 5% to about 30% by weight of the composition of anionic surfactant, more preferably
25 from about 8% to about 25%, yet more preferably from about 10% to about 20%.

Preferably the primary co-surfactant comprises amine oxide, more preferably the primary co-surfactant comprises at least 60% of amine oxide surfactant by weight of the primary co-surfactant. Preferably the primary co-surfactant comprises more than 80%, more preferably more
30 than 99% by weight of the primary co-surfactant of amine oxide. Preferred amine oxide surfactant for use herein is an alkyl dimethyl amine oxide.

Preferably, the composition of the invention comprises a secondary co-surfactant. Preferably the anionic surfactant and the secondary co-surfactant are present in the composition of the invention in a weight ratio of from about 2.2:1 to about 3.5:1.

- 5 Especially preferred compositions from a grease cleaning and good rinse feel comprise anionic surfactant, primary and secondary co-surfactants in a weight ratio of from about 1:1:0.25 to 2:1:0.7.

10 Preferably, the composition of the invention comprises a hydrotrope, more preferably sodium cumene sulfonate. The hydrotrope helps with the rheology profile of the composition. In particular it helps to thin the composition upon dilution that can contribute to faster release of cleaning actives and faster cleaning. This can be more important when the composition is used in manual dishwashing and the manual dishwashing takes place by delivering the composition onto a cleaning implement rather than delivering the composition onto a sink full of water.

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According to another aspect of the invention there is provided a method of manual dishwashing using the composition of the invention.

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There is also provided the use of the composition of the invention to provide grease cleaning and good feel during rinse.

The elements of the composition of the invention described in connection with the first aspect of the invention apply *mutatis mutandis* to the other aspects of the invention.

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DETAILED DESCRIPTION OF THE INVENTION

As used herein "liquid detergent composition" refers to those compositions that are employed in a variety of cleaning uses including dishes, or hard surfaces (e.g., floors, countertops etc), laundry, hair (e.g., shampoos), body, and the like. A preferred liquid detergent composition of the present invention is a "liquid dish detergent composition," which refers to those compositions
30 that are employed in manual (i.e. hand) dish washing. Such compositions are generally high sudsing or foaming in nature. By "dish," the term include dishes, glasses, pots, pans, baking dishes, flatware and the like, made from ceramic, china, metal, glass, plastic (polyethylene,

polypropylene, polystyrene, etc.), wood and the like. The composition of the invention is particularly good for the removal of grease from dishware, including plastic items.

Surfactant System

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The surfactant system of the composition of the invention comprises an anionic surfactant, a primary co-surfactant and optionally but preferably a secondary co-surfactant. The liquid detergent composition comprises from about 10% to about 40%, preferably from about 15% to about 35%, more preferably from about 18% to about 32% by weight of the composition of the surfactant system.

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Anionic Surfactant

The composition of the invention preferably comprises from 5% to 30%, more preferably 8% to 25% and especially from 10% to 20% of anionic surfactant by weight of the composition.

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The anionic surfactant can be a single surfactant but usually it is a mixture of anionic surfactants. Preferably the anionic surfactant comprises a sulfate surfactant, more preferably a sulfate surfactant selected from the group consisting of alkyl sulfate, alkyl alkoxy sulfate and mixtures thereof. Preferred alkyl alkoxy sulfates for use herein are alkyl ethoxy sulfates.

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The alkyl sulphate surfactant of the present invention preferably have the formula: $R_1O(A)_xSO_3M$, wherein the variables are herein defined. "R₁" is a C₁ – C₂₁ alkyl or alkenyl group, preferably from C₈-C₂₀, more preferably from C₁₀ - C₁₈. The alkyl or alkenyl group may be branched or linear. Where the alkyl or alkenyl group is branched, it preferably comprises C₁₋₄ alkyl branching units. The average weight percentage branching of the alkyl sulphate surfactant is preferably greater than 10%, more preferably from 15% to 80%, and most preferably from 20% to 40%, alternatively from 21% to 28%, alternatively combinations thereof. The branched alkyl sulphate surfactant can be a single alkyl sulphate surfactant or a mixture of alkyl sulphate surfactants. In the case of a single surfactant, the percentage of branching refers to the weight percentage of the hydrocarbyl chains that are branched in the original alcohol from which the surfactant is derived. In the case of a surfactant mixture, the percentage of branching is the weight average and it is defined according to the following formula: Weight average of

25

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branching (%) = $[(x_1 * \text{wt\% branched alcohol 1 in alcohol 1} + x_2 * \text{wt\% branched alcohol 2 in alcohol 2} + \dots) / (x_1 + x_2 + \dots)] * 100$; wherein x_1, x_2 , are the weight in grams of each alcohol in the total alcohol mixture of the alcohols which were used as starting material for the anionic surfactant. In the weight average branching degree calculation the weight of alkyl sulphate surfactant components not having branched groups should also be included.

Turning back to the above formula, "A" is an alkoxy group, preferably a $C_1 - C_5$ alkoxy group, more preferably a $C_1 - C_3$ alkoxy group, yet more preferably the alkoxy group is selected from ethoxy, propoxy, and mixtures thereof. In one embodiment, the alkoxy group is ethoxy. "x" represents a mole percentage average below 1, preferably from 0 to below 1, more preferably from 0.1 to 0.9, alternatively from 0.2 to 0.8, alternatively combinations thereof.

For purposes of clarification, the formula above describes certain alkyl alkoxy sulfates; more preferably the formula describes a mixture of alkyl sulfates and alkyl alkoxy sulfates such that the alkoxylation on mole percentage average (i.e., variable "x") is below 1. In the case of a surfactant mixture, the average degree of alkoxylation is the mole percent average and it is defined according to the following formula: Mole average degree of alkoxylation = $[(y_0 * 0 + y_1 * 1 + y_2 * 2 + \dots) / (y_0 + y_1 + y_2 + \dots)]$; wherein $y_0, y_1, y_2, \dots$ are the mole percent of each sulphated surfactant in the total alkyl mixture of sulphated surfactants having respectively 0, 1, 2, alkoxy units which are present in the detergent of the invention. For example, an alkyl sulphate of the following formula $\text{CH}_3(\text{CH}_2)_{13}\text{SO}_4 \text{ Na}$ will have a y value of 0 (i.e., y_0). An alkylethoxysulfate of the following formula $\text{CH}_3(\text{CH}_2)_{13}(\text{OCH}_2\text{CH}_2)\text{SO}_4 \text{ Na}$ will have a y value of 1 (i.e., y_1). An alkylethoxysulfate of the following formula: $\text{CH}_3(\text{CH}_2)_{10}(\text{OCH}_2\text{CH}_2)_4\text{SO}_4 \text{ Na}$ will have an y value of 4 (i.e., y_4). The mole amount of each the three molecules is taken into account to ultimately calculate the mole percentage average of variable "x" (in the formula $\text{R}_1\text{O}(\text{A})_x\text{SO}_3\text{M}$).

Regarding the formula $\text{R}_1\text{O}(\text{A})_x\text{SO}_3\text{M}$, "M" is a cation, preferably the cation is selected from an alkali metal, alkali earth metal, ammonium group, or alkanolammonium group; more preferably the cation is sodium.

The detergent composition can optionally further comprise other anionic surfactants. Non-limiting examples include sulphonate, carboxylate, sulfosuccinate and sulfoacetate anionic surfactants.

Primary co- surfactant

The composition of the invention comprises a primary co-surfactant. The composition preferably comprises from 3% to 25%, more preferably from 4% to 20% and especially from 5% to 15% by weight of the composition. The primary co-surfactant is selected from the group consisting of an amphoteric surfactant, a zwitterionic surfactant, and mixtures thereof. The composition of the present invention will preferably comprise an amine oxide as the amphoteric surfactant or betaine as the zwitterionic surfactant, or a mixture of said amine oxide and betaine surfactants.

Preferably the primary co-surfactant comprises an amphoteric surfactant. The amphoteric surfactant preferably comprises at least 40%, more preferably at least 50%, more preferably at least 60% and especially at least 80% by weight of an amine oxide surfactant. Alternatively the primary co-surfactant comprises an amphoteric and a zwitterionic surfactant, preferably the amphoteric and the zwitterionic surfactant are in a weight ratio of from about 2:1 to about 1:2, more preferably the amphoteric surfactant is an amine oxide surfactant and the zwitterionic surfactant is a betaine. Most preferably the co-surfactant is an amine oxide, especially alkyl dimethyl amine oxide.

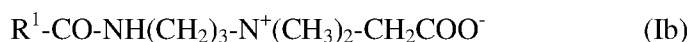
Most preferred among the amphoteric surfactants are amine oxides, especially coco dimethyl amine oxide or coco amido propyl dimethyl amine oxide. Amine oxide may have a linear or mid-branched alkyl moiety. Typical linear amine oxides include water-soluble amine oxides containing one R₁ C₈₋₁₈ alkyl moiety and 2 R₂ and R₃ moieties selected from the group consisting of C₁₋₃ alkyl groups and C₁₋₃ hydroxyalkyl groups. Preferably amine oxide is characterized by the formula R₁ – N(R₂)(R₃) O wherein R₁ is a C₈₋₁₈ alkyl and R₂ and R₃ are selected from the group consisting of methyl, ethyl, propyl, isopropyl, 2-hydroxyethyl, 2-hydroxypropyl and 3-hydroxypropyl. The linear amine oxide surfactants in particular may include linear C₁₀-C₁₈ alkyl dimethyl amine oxides and linear C₈-C₁₂ alkoxy ethyl dihydroxy ethyl amine oxides. Preferred amine oxides include linear C₁₀, linear C₁₀-C₁₂, and linear C₁₂-C₁₄ alkyl dimethyl amine oxides.

Most preferred among the zwitterionic surfactants are betaines, such as alkyl betaines, alkylamidobetaine, amidazoliniumbetaine, sulfobetaine (INCI Sultaines) as well as the Phosphobetaine and preferably meets formula I:

$R^1-[CO-X(CH_2)_n]_x-N^+(R^2)(R_3)-(CH_2)_m-[CH(OH)-CH_2]_y-Y$ (I) wherein

- 5 R^1 is a saturated or unsaturated C6-22 alkyl residue, preferably C8-18 alkyl residue, in particular a saturated C10-16 alkyl residue, for example a saturated C12-14 alkyl residue;
 X is NH, NR^4 with C1-4 Alkyl residue R^4 , O or S,
 n is a number from 1 to 10, preferably 2 to 5, in particular 3,
 x is 0 or 1, preferably 1,
 10 R^2 , R^3 are independently a C1-4 alkyl residue, potentially hydroxy substituted such as a hydroxyethyl, preferably a methyl.
 m is a number from 1 to 4, in particular 1, 2 or 3,
 y is 0 or 1 and
 Y is COO, SO₃, OPO(OR₅)O or P(O)(OR₅)O, whereby R₅ is a hydrogen atom H or a C1-4
 15 alkyl residue.

Preferred betaines are the alkyl betaines of the formula (Ia), the alkyl amido betaine of the formula (Ib), the Sulfo betaines of the formula (Ic) and the Amido sulfobetaine of the formula (Id);



- $R^1-CO-NH-(CH_2)_3-N^+(CH_3)_2-CH_2CH(OH)CH_2SO_3^-$ (Id) in which R^1 has the same meaning as in formula I. Particularly preferred betaines are the Carbobetaine [wherein $Y=COO^-$], in
 25 particular the Carbobetaine of the formula (Ia) and (Ib), more preferred are the Alkylamidobetaine of the formula (Ib).

- Examples of suitable betaines and sulfobetaine are the following [designated in accordance with INCI]: Almondamidopropyl of betaines, Apricotamidopropyl betaines, Avocamidopropyl of
 30 betaines, Babassuamidopropyl of betaines, Behenamidopropyl betaines, Behenyl of betaines, betaines, Canolamidopropyl betaines, Capryl/Capram idopropyl betaines, Carnitine, Cetyl of betaines, Cocamidoethyl of betaines, Cocamidopropyl betaines, Cocamidopropyl Hydroxysultaine, Coco betaines, Coco Hydroxysultaine, Coco/Oleamidopropyl betaines, Coco

Sultaine, Decyl of betaines, Dihydroxyethyl Oleyl Glycinate, Dihydroxyethyl Soy Glycinate, Dihydroxyethyl Stearyl Glycinate, Dihydroxyethyl Tallow Glycinate, Dimethicone Propyl of PG-betaines, Erucam idopropyl Hydroxysultaine, Hydrogenated Tallow of betaines, Isostearam idopropyl betaines, Lauram idopropyl betaines, Lauryl of betaines, Lauryl Hydroxysultaine, 5 Lauryl Sultaine, Milkam idopropyl betaines, Minkamidopropyl of betaines, Myristam idopropyl betaines, Myristyl of betaines, Oleam idopropyl betaines, Oleam idopropyl Hydroxysultaine, Oleyl of betaines, Olivamidopropyl of betaines, Palmam idopropyl betaines, Palm itam idopropyl betaines, Palmitoyl Carnitine, Palm Kernelam idopropyl betaines, Polytetrafluoroethylene Acetoxypentyl of betaines, Ricinoleam idopropyl betaines, Sesam idopropyl betaines, Soyam 10 idopropyl betaines, Stearam idopropyl betaines, Stearyl of betaines, Tallowam idopropyl betaines, Tallowam idopropyl Hydroxysultaine, Tallow of betaines, Tallow Dihydroxyethyl of betaines, Undecylenam idopropyl betaines and Wheat Germam idopropyl betaines.

A preferred betaine is, for example, Cocoamidopropyl betaines (Cocoamidopropylbetain).

15 Secondary co-surfactant

Preferably the composition of the invention comprises a non-ionic surfactant as secondary co-surfactant. Preferably from 0.1 to 10%, more preferably from 1% to 8%, especially from 3% to 6% of a nonionic surfactant by weight of the composition. Suitable nonionic surfactants include the 20 condensation products of aliphatic alcohols with from 1 to 25 moles of alkylene oxide, preferably ethylene oxide. The alkyl chain of the aliphatic alcohol can either be straight or branched, primary or secondary, and generally contains from 8 to 22 carbon atoms. Particularly preferred are the condensation products of alcohols having an alkyl group containing from 8 to 18 carbon atoms, preferably from 10 to 15 carbon atoms, alternatively from 9 to 11 carbon atoms, 25 alternatively from 12 to 14 carbon atoms, alternatively combinations thereof; with from 2 to 18 moles, preferably 2 to 15 moles, more preferably 5 to 12 moles of ethylene oxide per mole of alcohol. A preferred non-ionic surfactant includes an aliphatic alcohol with from 1 to 25 moles of ethylene oxide, preferably condensation products of alcohols having an alkyl group containing from 8 to 18 carbon atoms, with from 2 to 18 moles of ethylene oxide per mole of alcohol.

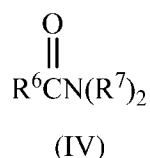
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Also suitable are alkylpolyglycosides having the formula $R^2O(C_nH_{2n}O)_x(\text{glycosyl})_x$ (formula (III)), wherein R^2 of formula (III) is selected from the group consisting of alkyl, alkyl-phenyl, hydroxyalkyl, hydroxyalkylphenyl, and mixtures thereof in which the alkyl groups contain from

10 to 18, preferably from 12 to 14, carbon atoms; n of formula (III) is 2 or 3, preferably 2; t of formula (III) is from 0 to 10, preferably 0; and x of formula (III) is from 1.3 to 10, preferably from 1.3 to 3, most preferably from 1.3 to 2.7. The glycosyl is preferably derived from glucose. Also suitable are alkylglycerol ethers and sorbitan esters.

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Also suitable are fatty acid amide surfactants having the formula (IV):



wherein R^6 of formula (IV) is an alkyl group containing from 7 to 21, preferably from 9 to 17, carbon atoms and each R^7 of formula (IV) is selected from the group consisting of hydrogen, C_1 - C_4 alkyl, C_1 - C_4 hydroxyalkyl, and $-(\text{C}_2\text{H}_4\text{O})_x\text{H}$ where x of formula (IV) varies from 1 to 3. Preferred amides are C_8 - C_{20} ammonia amides, monoethanolamides, diethanolamides, and isopropanolamides.

Most preferably the nonionic surfactant is a condensation product of an aliphatic alcohol with ethyleneoxide.

Preferably, the compositions of the present invention are free or substantially free of cationic surfactant.

20 Cyclic diamine

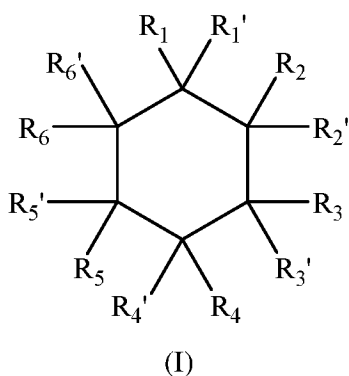
The composition of the invention preferably comprises from about 0.1% to about 10%, more preferably from about 0.2% to about 5%, and especially from about 0.3% to about 2%, by weight of the composition, of a cyclic diamine of Formula (I).

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The term "cyclic diamine" herein encompasses a single cleaning amine and a mixture thereof. The amine can be subjected to protonation depending on the pH of the cleaning medium in which it is used.

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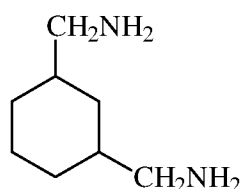
Cyclic diamine of Formula (I):



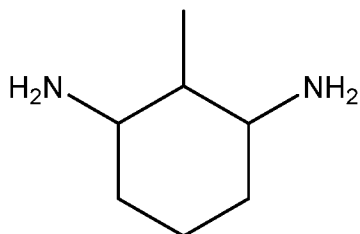
two of the substituents $R_s(R_1-R_6, R_1'-R_6')$ are independently selected from the group consisting of NH_2 , $(C_1-C_4)NH_2$ and mixtures thereof and the remaining substituents R_s are independently
 5 selected from H, linear or branched alkyl or alkenyl having from 1 to 10 carbon atoms.

The amine of Formula (I) is a cyclic amine with two primary amine functionalities. The primary amines can be in any position in the cycle but it has been found that in terms of grease cleaning, better performance can be obtained when the primary amines are in positions 1,3. It has also
 10 been found advantageous in terms of grease cleaning amines in which one of the substituents is - CH_3 and the rest are H.

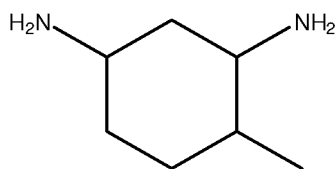
Preferred cyclic diamines for use herein are selected from the group consisting of:



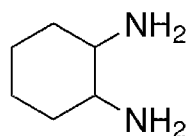
1, 3-bis(methylamine)-cyclohexane,



2-methylcyclohexane-1,4-diamine,

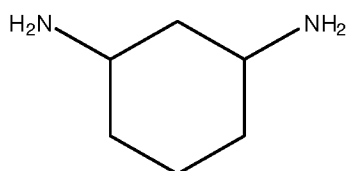


4-methylcyclohexane-1,4-diamine,

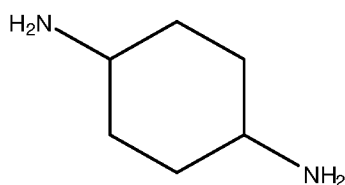


Cyclohexane-1,2-diamine

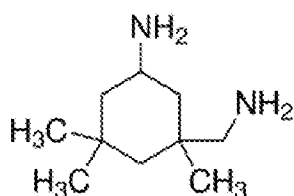
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Cyclohexane-1,3-diamine,



Cyclohexane-1,4-diamine,



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Isophorone diamine; and a mixture thereof.

Especially preferred for use herein are cyclic diamines selected from the group consisting of 1, 3-bis(methylamine)-cyclohexane, 2-methylcyclohexane-1,3-diamine, 4-methylcyclohexane-1,3-diamine and mixtures thereof. 1, 3-bis(methylamine)-cyclohexane is especially preferred for use herein. Mixtures of 2-methylcyclohexane-1,3-diamine, 4-methylcyclohexane-1,3-diamine are also preferred for use herein.

Water

The liquid detergent compositions preferably comprise water. The water may be added to the composition directly or may be brought into the composition with raw materials. In any event, the total water content of the composition herein may comprise from 10% to 95% water by weight of the liquid dish detergent compositions. Alternatively, the composition may comprise from 20% to 95%, alternatively from 30% to 90%, or from 40% to 85% alternatively combinations thereof, of water by weight of the liquid dish detergent composition.

10 Organic Solvents

The present compositions may optionally comprise an organic solvent, different from the cyclic diamine of Formula (I). Suitable organic solvents include C₄₋₁₄ ethers and diethers, polyols, glycols, alkoxyated glycols, C₆-C₁₆ glycol ethers, alkoxyated aromatic alcohols, aromatic alcohols, aliphatic linear or branched alcohols, alkoxyated aliphatic linear or branched alcohols, alkoxyated C₁-C₅ alcohols, C₈-C₁₄ alkyl and cycloalkyl hydrocarbons and halohydrocarbons, and mixtures thereof. Preferably the organic solvents include alcohols, glycols, and glycol ethers, alternatively alcohols and glycols. In one embodiment, the liquid detergent composition comprises from 0% to less than 50% of a solvent by weight of the composition. When present, the liquid detergent composition will contain from 0.01% to 20%, alternatively from 0.5% to 15%, alternatively from 1% to 10% by weight of the liquid detergent composition of said organic solvent. Non-limiting examples of specific solvents include propylene glycol, polypropylene glycol, propylene glycol phenyl ether, ethanol, and combinations thereof. In one embodiment, the composition comprises from 0.01% to 20% of an organic solvent by weight of the composition, wherein the organic solvent is selected from glycols, polyalkyleneglycols, glycol ethers, ethanol, and mixtures thereof.

Hydrotrope

The liquid detergent compositions optionally comprises a hydrotrope in an effective amount, i.e. from 0 % to 15%, or from 0.5 % to 10 % , or from 1 % to 6 % , or from 0.1% to 3%, or combinations thereof, so that the liquid dish detergent compositions are compatible or more compatible in water. Suitable hydrotropes for use herein include anionic-type hydrotropes,

particularly sodium, potassium, and ammonium xylene sulfonate, sodium, potassium and ammonium toluene sulfonate, sodium potassium and ammonium cumene sulfonate, and mixtures thereof, as disclosed in U.S. Patent 3,915,903. In one embodiment, the composition of the present invention is isotropic. An isotropic composition is distinguished from oil-in-water emulsions and lamellar phase compositions. Polarized light microscopy can assess whether the composition is isotropic. See e.g., *The Aqueous Phase Behaviour of Surfactants*, Robert Laughlin, Academic Press, 1994, pp. 538-542. In one embodiment, an isotropic dish detergent composition is provided. In one embodiment, the composition comprises 0.1% to 3% of a hydrotrope by weight of the composition, preferably wherein the hydrotrope is selected from sodium, potassium, and ammonium xylene sulfonate, sodium, potassium and ammonium toluene sulfonate, sodium potassium and ammonium cumene sulfonate, and mixtures thereof.

Calcium / Magnesium ions

Calcium ion and/or Magnesium ion, preferably Magnesium ion, are added, preferably as a hydroxide, chloride, acetate, sulphate, formate, oxide or nitrate salt, to the compositions of the present invention, typically at an active level of from 0.01% to 1.5%, preferably from 0.015% to 1%, more preferably from 0.025 % to 0.5%, by weight of the liquid detergent composition. In one embodiment, the composition comprises from 0.01% to 1.5% of a calcium ion or magnesium ion, or mixtures thereof, by weight of the composition, preferably the magnesium ion.

Adjunct Ingredients

The liquid detergent compositions herein can optionally further comprise a number of other adjunct ingredients suitable for use in liquid detergent compositions such as perfume, colorants, pearlescent agents, opacifiers, suds stabilizers / boosters, cleaning and/or shine polymers, rheology modifying polymers, structurants, chelants, skin care actives, suspended particles, enzymes, anti-caking agents, viscosity trimming agents (e.g. salt such as NaCl and other mono-, di- and trivalent salts), preservatives and pH trimming and/or buffering means (e.g. carboxylic acids such as citric acid, HCl, NaOH, KOH, alkanolamines, phosphoric and sulfonic acids, carbonates such as sodium carbonates, bicarbonates, sesquicarbonates, borates, silicates, phosphates, imidazole and alike).

pH

The liquid detergent compositions herein preferably have a pH adjusted to between 8 and 10, alternatively from 8.5 to 9.5, alternatively combinations thereof. pH is determined by the liquid
5 detergent composition diluted with deionized water making a 10% product concentration by weight (i.e., 10% product and 90% water, by weight). The pH of the composition can be adjusted using pH trimming and/or buffering means known in the art.

Viscosity

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The liquid detergent compositions of the present invention can be Newtonian or non-Newtonian with a viscosity of between 1 centipoises (cps) and 5,000cps at 20 °C and, alternatively between 10cps and 2,000cps, or between 50cps and 1,500cps, or between 100cps and 1,000cps, alternatively combinations thereof.

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Viscosity is measured with a BROOFIELD DV-E viscometer, at 20°C, spindle number 31. The following rotations per minute (rpm) should be used depending upon the viscosity: Between 300 cps to below 500 cps is at 50 rpm; between 500 cps to less than 1,000 cps is at 20 rpm; from 1,000 cps to less than 1,500 cps at 12 rpm; from 1,500 cps to less than 2,500 cps at 10 rpm; from
20 2,500 cps, and greater, at 5 rpm. Those viscosities below 300 cps are measured at 12 rpm with spindle number 18.

Packaging

25 The liquid detergent compositions of the present invention may be packed in any suitable packaging for delivering the liquid detergent composition for use. In one preferred embodiment, the package may be comprised of polyethylene terephthalate, high-density polyethylene, low-density polyethylene, or combinations thereof. Furthermore, preferably, the package may be dosed through a cap at the top of the package such that the composition exits the bottle through
30 an opening in the cap. The cap may be a push-pull cap or a flip top cap.

Method of the invention

The method of the invention comprises the steps of:

i) delivering a detergent composition in its neat form onto the dishware or a cleaning implement.

5 By “neat form” is herein meant that the detergent composition is delivered onto the dishware or cleaning implement as it is, without previously diluting the composition with water.

ii) cleaning the dishware with the detergent composition in the presence of water. The water can be present by putting the dishware under a running tap, wetting the cleaning implement, etc and

iii) optionally rinsing the dishware.

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The dimensions and values disclosed herein are not to be understood as being strictly limited to the exact numerical values recited. Instead, unless otherwise specified, each such dimension is intended to mean both the recited value and a functionally equivalent range surrounding that value. For example, a dimension disclosed as “40 mm” is intended to mean “about 40 mm.”

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EXAMPLES

Example 1

The following compositions were prepared by mixing the individual raw materials.

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	Comparative Example 1		Example 1	
% active by weight of the composition	High AES/AO ratio	High AES/AO ratio + 0.5% 1,3-BAC	Low AES/AO ratio	Low AES / AO ratio + 0.5% 1,3-BAC
wt% surfactant	31.25	31.25	31.25	31.25
AES	23.94	23.94	12.89	12.89
AO	6.84	6.84	12.89	12.89
AES:AO weight ratio	3.5/1	3.5/1	1/1	1/1
NI	0.46	0.46	5.47	5.47
1,3-BAC	-	0.5	-	0.5
Sodium Chloride	1.2	1.2	1	1
PPG	1.2	1.2	0.2	0.2
Ethanol	Up to 500 cps	Up to 500 cps	Up to 500 cps	Up to 500 cps

Water and minors (dye, preservative, perfume)	Up to 100%	Up to 100%	Up to 100%	Up to 100%
pH (10% dilution in demi water at 20°C)	9	9	9	9

AES: C12-13 alkyl ethoxylate sulfate with an average degree of ethoxylation of 0.6

AO: C12-14 dimethylamine oxide

NI: C10EO8

1,3-BAC = 1,3-bis(aminomethyl)cyclohexane

- 5 PPG: Polypropyleneglycol having a molecular weight of 2,000

Example 2

The following compositions were prepared by mixing the individual raw materials.

	Comparative Example 2		Example 2	
% active by weight of the composition	High AES/AO ratio	High AES/AO ratio + 1% Baxxodur ECX210	Low AES/AO ratio	Low AES / AO ratio + 1% Baxxodur ECX210
wt% surfactant	31.25	31.25	31.25	31.25
AES	23.94	23.94	12.89	12.89
AO	6.84	6.84	12.89	12.89
AES:AO weight ratio	3.5/1	3.5/1	1/1	1/1
NI	0.46	0.46	5.47	5.47
Baxxodur ECX210	-	1.0	-	1.0
Sodium Chloride	1.2	1.2	1	1
PPG	1.2	1.2	0.2	0.2
Ethanol	Up to 500 cps	Up to 500 cps	Up to 500 cps	Up to 500 cps
Water and minors (dye, preservative, perfume)	Up to 100%	Up to 100%	Up to 100%	Up to 100%
pH (10% dilution in demi water at 20°C)	9	9	9	9

AES: C12-13 alkyl ethoxylate sulfate with an average degree of ethoxylation of 0.6

- 10 AO: C12-14 dimethylamine oxide

NI: C10EO8

Baxxodur ECX210: mixture of 4-methylcyclohexane-1,3-diamine and 2-methylcyclohexane-1,3-diamine, available from BASF.

PPG: Polypropyleneglycol having a molecular weight of 2,000

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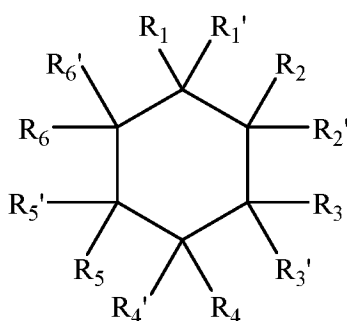
It has been found that the cyclic diamines of Formula (I) work better on grease cleaning in compositions having low anionic to amphoteric surfactant ratio (Example 1 and Example 2, according to the invention), than in compositions having high anionic to amphoteric surfactant ratio (Comparative Example 1 and Example 2).

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CLAIMS

What is claimed is:

1. A liquid detergent composition comprising a surfactant system, the surfactant system comprising an anionic surfactant and a primary co-surfactant selected from the group consisting of amphoteric surfactant, zwitteronic surfactant and mixtures thereof wherein the anionic surfactant and the primary co-surfactant are in a weight ratio of less than 2.5:1 and wherein the composition further comprises a cyclic diamine of Formula(I):



(I)

- wherein two of the Rs are selected from the group consisting of NH₂, (C₁-C₄)NH₂ and mixtures thereof and the remaining Rs are independently selected from H, linear or branched alkyl or alkenyl having from 1 to 10 carbon atoms.
2. A composition according to claim 1 wherein the anionic surfactant and the primary co-surfactant are in a weight ratio of from about 2:1 to about 1:1.
3. A composition according to any of claims 1 or 2 wherein the anionic surfactant comprises an alkyl alkoxylate sulfate having an average alkoxylation degree of from about 0.2 to about 3.
4. A composition according to any of the preceding claims wherein the anionic surfactant comprises a branched anionic surfactant having an average level of branching of from about 5% to about 40%.
5. A composition according to any of the preceding claims wherein the co-surfactant is an amphoteric surfactant comprising an amine oxide.

6. A composition according to any of the preceding claims wherein the surfactant system further comprises a secondary co-surfactant comprising a non-ionic surfactant, preferably an alkyl ethoxylated surfactant, preferably comprising from 9 to 15 carbon atoms in its alkyl chain and from 5 to 12 units of ethylene oxide per mole of alcohol.

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7. A composition according to the preceding claim wherein the anionic surfactant and the non-ionic surfactant are in a weight ratio of from about 2.2:1 to about 3.5:1.

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8. A composition according to any of claims 6 or 7 wherein the weight ratio of the anionic surfactant to the primary and to the secondary co-surfactants is from about 1:1.0:25 to about 2:1:0.7.

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9. A composition according to any of the preceding claims comprising 10 to 40% by weight of the composition of the surfactant system.

10. A composition according to any of the preceding claims having a pH from 8 to 10 as measured at 10% solution in distilled water at 20°C.

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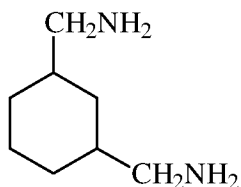
11. A composition according to any of the preceding claims comprising from 0.1 to 5%, preferably from 0.1 to 2% by weight of the composition of the cyclic diamine.

12. A composition according to any of the preceding claims wherein the remaining Rs, are selected from H, CH₃ and mixtures thereof.

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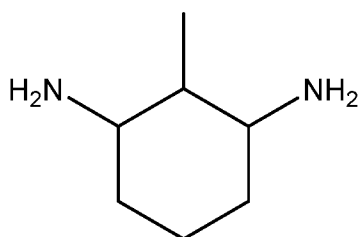
13. A composition according to any of the preceding claims wherein the two Rs selected from the group consisting of NH₂, (C₁-C₄)NH₂ and mixtures thereof are in positions 1 and 3.

14. A composition according to any of claims 1 to 12 wherein the cyclic diamine is selected from the group consisting of:

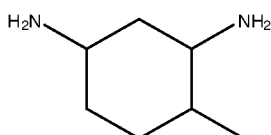


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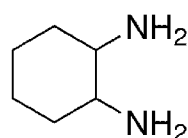
1, 3-bis(methylamine)-cyclohexane,



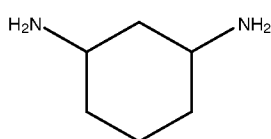
2-methylcyclohexane-1,4-diamine,



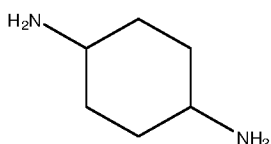
4-methylcyclohexane-1,4-diamine,



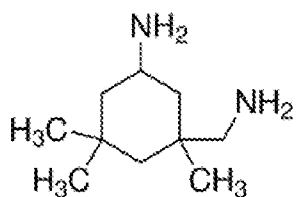
Cyclohexane-1,2-diamine,



Cyclohexane-1,3-diamine,



Cyclohexane-1,4-diamine,



Isophoronediamine, and a mixture thereof.

15. A composition according to the any of claims 1 to 11 wherein the cyclic diamine is selected from the group consisting of 1, 3-bis(methylamine)-cyclohexane, 2-methylcyclohexane-1,3-diamine, 4-methylcyclohexane-1,3-diamine and mixtures thereof.

16. A composition according to any of claims 6 to 15 wherein the anionic surfactant is an alkyl ethoxylated sulfate surfactant, preferably having an average degree of ethoxylation of from about 0.2 to about 3 wherein the primary co-surfactant is an amine oxide surfactant, preferably an alkyl dimethyl amine oxide, wherein the secondary co-surfactant is a non-ionic surfactant, preferably an alkyl ethoxylated surfactant comprising from 9 to 15 carbon atoms in its alkyl chain and from 5 to 12 units of ethylene oxide per mole of alcohol and wherein the cleaning amine is 1,3-bis (aminomethyl) cyclohexane.
17. A composition according to any of claims 6 to 15 wherein the anionic surfactant is an alkyl ethoxylated sulfate surfactant, preferably having an average degree of ethoxylation of from about 0.2 to about 3 wherein the primary co-surfactant is an amine oxide surfactant, preferably an alkyl dimethyl amine oxide, wherein the secondary co-surfactant is a non-ionic surfactant, preferably an alkyl ethoxylated surfactant comprising from 9 to 15 carbon atoms in its alkyl chain and from 5 to 12 units of ethylene oxide per mole of alcohol and wherein the cleaning amine is selected from the group consisting of 2-methylcyclohexane-1,3-diamine, 4-methylcyclohexane-1,3-diamine and mixtures thereof.
18. A composition according to any of the preceding claims wherein the composition is a hand dishwashing detergent composition.
19. A method of manually washing dishware comprising the steps of:
- i) delivering a detergent composition according to any of the preceding claims preferably in its neat form onto the dishware or a cleaning implement;
 - ii) cleaning the dishware with the detergent composition in the presence of water; and
 - iii) optionally rinsing the dishware.
20. Use of a composition according to any of the preceding claims to provide grease cleaning in manual dishwashing.
21. Use of a composition according to any of claims 1 to 18 to provide a good rinse feel in manual dishwashing.

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2016/041021

A. CLASSIFICATION OF SUBJECT MATTER INV. C11D1/75 C11D1/83 C11D1/94 C11D3/30 C11D11/00 ADD.		
According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED		
Minimum documentation searched (classification system followed by classification symbols) C11D		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) EPO-Internal, WPI Data		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 01/25379 A1 (PROCTER & GAMBLE) 12 April 2001 (2001-04-12) claim 12; examples III, IV -----	1-21
X	EP 1 674 560 A1 (PROCTER & GAMBLE) 28 June 2006 (2006-06-28) paragraph [0036]; example -----	1-21
X	US 6 573 234 B1 (SIVIK MARK ROBERT ET AL) 3 June 2003 (2003-06-03) tables VII, VIII -----	1-21
☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.		
* Special categories of cited documents : "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier application or patent but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family		
Date of the actual completion of the international search 19 September 2016		Date of mailing of the international search report 26/09/2016
Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016		Authorized officer Hillebrecht, Dieter

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2016/041021

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