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(54) Detergent composition comprising betaine and ether sulphate.

(57) A light duty liquid detergent, especially suitable for hand dishwashing. The detergent comprises an essentially binary active system of (i) amidoalkyl betaines or amidoalkylsulobetaines and (ii) alkyl ether sulfates in a weight ratio of 1:4 to 1:1, preferably 1:3. to 1:1, together with hydrotropes and water and certain optional ingredients. The light duty liquids have excellent mildness and foaming properties and do not require large amounts of surfactants.

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DETERGENT COMPOSITION COMPRISING BETAINE AND ETHER SULFATE

BACKGROUND OF THE INVENTION

Two particularly important characteristics of hand dishwashing detergent liquids are mildness, which is significant due to the exposure of the hands to the detergent formulations, and foamability. Foamability is important because the amount of foam generated during washing is related to the ability of a formulation to clean dishes and eating utensils effectively.

Among the surfactants included to promote mildness in some light duty liquid detergent formulations are certain betaine surfactants and linear ether sulfates. However, such formulations have tended generally to include high levels of total surfactant high levels of the costly betaine surfactants and/or one or more extra surfactants in addition to the betaine and ether sulfates.

Rubin et al., US Patent No. 4 375 421 discloses high viscosity aqueous compositions including alkylamidobetaines and selected salts such as certain sulfates, carbonates, citrates, tartrates and succinates.

The inclusion of micelle-forming anionic surfactants are said to produce a synergistic, viscosity-building effect.

Among the numerous types of anionics mentioned for use in their invention are included sodium, potassium, calcium, magnesium and ammonium alcohol ethoxy sulfates. In Examples 6-B and 6-C, hand dishwashing preparations are disclosed which include cocoamido betaine, ammonium alcohol ethoxy sulfate, lauryl dimethyl amine oxide and either sodium citrate or sodium sulfate. The ratio of betaine to ether sulfate is much greater than 1:1. Rubin et al. indicate that the particular type of betaine is important and that most betaines are not thickened in the presence of salts. It is said that only alkylamidobetaines are thickened under the described conditions.

Chirash et al., U.S. Patent No. 4,772,425 discloses light duty liquid abrasive-containing dishwashing compositions which include at least one sulfated or sulfonated anionic surfactant, a betaine, a clay stabilizing agent and a minor amount of a solubilizer such as ethanol as a preferred optional ingredient. Preferably, the formulation includes a ternary surfactant system of an alkyl benzyl sulfonate or alkane sulfonate, an alkyl ethenoxy ether sulfate and a betaine, the clay, and 2 to 9% alcohol

Several of the examplified compositions of Chirash include ether sulfate and betaine surfactants and ethanol. For instance, a composition including 17% sodium dodecylbenzene sulfonate, 13% ammonium alkyl triethenoxyether sulfate, 4% cocamidopropyl dimethyl betaine, 5.5% ethanol and water is disclosed. In example 6, 6.5% ether sulfate, 2% amidoalkyl betaine, 8.5% sodium dodecylbenzene sulfonate and 4% alcohol are included. The examples including ether sulfate and betaine appear to possess ternary surfactant systems.

Verdicchio et al., U.S. Patent No. 3,950,417 discloses high lathering detergent compositions, especially useful as shampoos, which comprise a surfactant betaine, an anionic surfactant and a nonionic surfactant. The preferred molar ratio of surfactant betaine to anionic surfactant falls between about 0.9 and about 1.1. The preferred betaines are said to be surfactant amidocarboxybetaines and amidosulfobetaines. Alcohol ether sulfates are used as anionics and are said to be the preferred anionics. The examples generally include a nonionic surfactant in addition to the betaines and the anionic surfactant such as ether sulfates. In addition to use as shampoos, the compositions are said to be useful as cleansers for cleaning other parts of the human body, animals, inanimate objects and the like.

Nishimura et al., U.S. Patent No. 4,166,048 discloses high foaming detergent compositions which are said to have a very mild action on the skin. The compositions include certain polyoxyethylene alkyl ether sulfate salt mixtures and a betaine-type amphoteric surfactant of the formula R1(R2)N+(CH2COO-)R3 wherein R1 is alkyl having 8 to 20 carbon atoms. The weight of the betaine type amphoteric surfactant is 0.01 to 2 times, especially 0.03 to 0.5 times the weight of the polyoxyethylene alkyl ether sulfate salt mixture.

The ether sulfate salts of the '048 patent may include monovalent metal ions, preferably Na or K or divalent metal ions, preferably Ca or Mg. Solubilizing agents such as ethanol, propylene glycol, glycerin and xylene sulfonic acid salts may be included. In some of the examples, the composition is tested for washing power on dishes. Small amounts of ammonium chloride are included in some of the examples.

The Lonzaine C Product Information Bulletin discloses that Lonzane C is a mild, high foaming surfactant of the amide betaine structure. Lonzaine C is said to contain 5% NaCl. Lonzaine C is said to have outstanding conditioning, foaming, and viscosity potentiating properties. Lonzaine C, in combination with most anionic surfactants, is said to potentiate viscosity to permit formulations ranging from viscous liquids

to ringing gels.

Shampoo formulations including a 30% solution of Lonzaine C (14%), Barlox C, a 40% solution of sodium alpha olefin sulfonate (22%), citric acid, water and optionally polymer JR 125 are disclosed. Lonzaine C is said to be useful in light duty liquids and is said to exhibit tolerance toward high levels of builder, electrolytes, alkali and acids.

The Stepan bulletin for Amphosol CA (cocoamidopropyl betaine) gives a shampoo formulation including Amphosol CA, an amine oxide, an alpha olefin sulfonate, citric acid and water. In three other formulas, the anionic is respectively sodium lauryl sulfate, another alcohol sulfate salt and alpha olefin sulfonate. It is said that a wide variety of viscosities can be attained by addition of NaCl (from 0 to a gel).

Pancheri et al., U.S. Patent No. 4,772,423 discloses liquid detergents said to have high sudsing characteristics and said to be suitable for washing tableware. The detergents comprise 5 to 50% anionic surfactant, a polmeric surfactant, detergency builders and water and may also include other surfactants, of which betaine surfactants are highly preferred.

The betaine is present at from 0.5 to 15%, preferably from 1 to 10%. The ratio of anionic to betaine is from about 1 to 80, preferably from 1 to 40 more preferably from about 2 to 40. The preferred anionic surfactants are alkylpolyethoxylate sulfates having from 0.5 to 10 ethylene oxide groups. The anionics may be salts of sodium, potassium, ammonium, monoethanolammonium, diethanolammonium, triethanolammonium and other cations. Alcohols and hydrotropes such as sodium xylene sulfonate may be included, as may water-soluble inorganic builders. Alkyl ether sulfates and alkylamido betaines are included together in various examples, generally with an additional surfactant.

Lamb et. al., U.S. Patent No. 4,671,894 discloses liquid dishwashing detergents comprising 4 to 20% alkyl sulfate, 5 to 20% alkylbenzene sulfonate, 1 to 10% of a nonionic surfactant, 5 to 24% alkyl ethoxy sulfate, 0.25 to 10% of a zwitterionic surfactant such as an alkyl betaine, an alkylamidobetaine or a sulfobetaine, and a hydrotrope-water system which may include ethanol, urea, and/or a lower alkyl benzene sulfonate. In example D, 9.9% ammonium alkyl ethoxy sulfate, 2.25% amidopropyl betaine, ethanol, alkylbenzene sulfonate, alkyl sulfate and water are included. In comparative Example M, alkylbenzene sulfonate is omitted and a marked decline in suds mileage is said to be obtained.

Klisch et al., U.S Patent No. 4,554,098 discloses good foaming liquid detergents having reduced skin irritating properties which include 8 to 30% alkyl ether sulfate, a supplementary, non-soap anionic detergent, 1 to 8% of a zwitterionic surfactant which may be a betaine, an amidobetaine or a sulfobetaine and a solubilizer which is selected from a group including alcohols, lower alkyl benzene sulfonate salts, urea and mixtures thereof. The formulations are said to be suitable as hand dishwashing liquids.

Example 5 of Klisch includes 16% ammonium alkyl ether sulfate salt, 6% sodium alkyl ether sulfate salt, 4% amidobetaine, 3% monoethanolamide, 5.4% sodium xylene sulfonate and 9.5% ethanol. Example 35 includes 13% ammonium alkyl ether sulfate, 2% ammonium lauryl sulfate, 4.5% amidobetaine, 1.5% monoethanolamide, 9.2% ethanol, and 4.2% sodium xylene sulfonate.

Bissett et. al., U.S. Patent No. 4,558,360 discloses mild, foaming detergent compositions comprising 5 to 99% of a mild, foaming anionic surfactant selected from a group including alkyl ether sulfates, 1 to 30% of a surfactant which may be a betaine or an amidobetaine and 0.5 to 20% of an amine oxide suds booster. The ratio of anionic detergent to the betaine is from 1:1 to 20:1, preferably 3:1 to 10:1. Detergency builders, solvents such as ethanol and water, and hydrotropes such as sodium xylene sulfonate may be included. In Example III, 27% alkyl ether sulfate, 5% amine oxide, and 10% cetyl dimethyl betaine are present.

Carter et. al., U.S. Patent No. 4,088,612 discloses compositions which include certain sulfobetaines and an anionic surfactant in a molar ratio of not less than 1 to 2 parts. Among the anionics listed are ether sulfates. In Table II a formulation including hexadecyl pyridino sulfobetaines and sodium lauryl ethylene oxide (BEC) ether sulfate in a 1:1 molar ratio is given. Compositions including sulfobetaines and ether sulfates are also given in Table I. Hydrotropes such as alkali metal aryl sulfonates, organic solvents such as lower alcohols, and salts such as sodium sulfate may be included.

European Patent Application 036,625 discloses liquid cleaning compositions said to be useful for washing dishes by hand. The compositions include by weight 4-20% of a mixture of sulfated ethylene oxide/alkanol adducts, and aditionally 2-5% surface active betaines in addition to one or more anionic tensides, optionally nonionic tensides, solvents and other ingredients. Example 4 appears to include 9% alkylbenzene sulfonate, 9% alkyl ether sulfate, 2% alkyamidopropyldimethylcarboxymethylbetaine and 10% ethanol. Example 6 appears to include 10% alkylbenzenesulfonate, 10% alkylsulfonate, 5% alkyl ether sulfate, 5% amidobetaine and 8% isopropanol. Example 9 appears to include 5% alkyl ether sulfate, 2% betaine, 3% alkylsulfate, 5% nonionic and 4% isopropanol.

It has now been found that light duty liquid detergent formulations having a ratio of amido- and/or amido sulfobetaine surfactants to linear ether sulfate within the range defined below exhibit excellent mildness and

foaming without the need for additional surfactants or excessive amounts of betaine or of total surfactant.

SUMMARY OF THE INVENTION

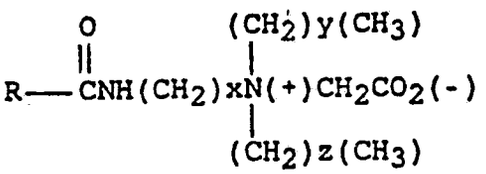
The invention comprises aqueous light duty liquid detergent formulations, especially suitable for use in hand dishwashing, which include a) an essentially binary active system consisting essentially of i) a betaine surfactant which may be an alkylamidobetaine or a amidosulfobetaine or mixtures thereof and ii) an alkyl ether sulfate surfactant, wherein the weight ratio of i) to ii) is in the range of 1:4 to 1:1, b) from 1 to 12% of a hydrotrope and c) from 0 to 12% of electrolytes. Preferably the range of i) to ii) is from 1:3 to 1:1, even more preferably 1:2 to 1:1.5.

The light duty liquid detergent of the invention has been found to have excellent mildness and foaming properties, and is particularly suitable for use as a hand dishwashing liquid. Moreover, the liquid of the invention does not require large amounts of the betaine or of total surfactant and uses an essentially binary active system, thus eliminating the need for additional surfactants.

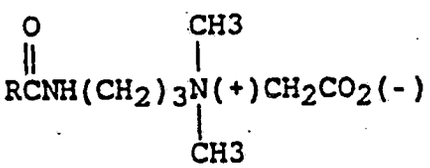
DETAILED DESCRIPTION OF THE INVENTION

The betaine surfactants useful in the invention are zwitterionic surfactants and are either alkylamidobetaines or alkylamidosulfobetaines.

The alkylamidobetaines useful in the present invention are given by the following formula:



where R is an alkyl or alkenyl chain containing 9 to 17 carbon atoms, x is an integer of 2 to 4, y is an integer of 0 to 3, and z is an integer of 0 to 3. The preferred value of x is 3. The preferred values of y and z are both 0. R is preferably a fatty group which contains 11 to 13 carbon atoms, most preferably in a straight chain. The preferable source of the R group is coconut oil. The preferred amidobetaine may be represented by the following formula:

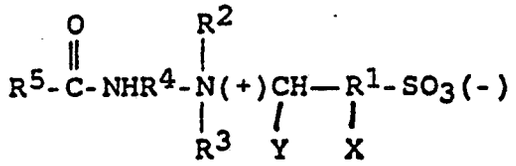


wherein R is an alkyl or alkenyl group containing 9 to 13 carbon atoms.

Examples of the alkylamidobetaines useful in the present invention include cocoamidomethylbetaine, laurylamidopropylbetaine, and cetylamidomethylbetaine.

Alkylamidobetaines useful in the present invention are commercially available from, e.g. Lonza Incorporated under the trademark Lonzaine C; from the Miranol Chemical Company under the trademark Mirataine CB; and from the Stepan Chemical Co. under the trademark Amphosol CA.

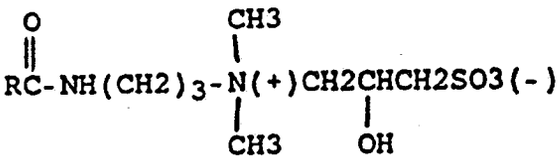
The alkylamidosulfobetaines useful in the invention have the following formula:



wherein R1 is an alkylene radical having from 1 to about 3 carbon atoms, X is hydrogen, methyl or hydroxy, Y is hydrogen or methyl, R^2 and R^3 are independently selected from methyl, ethyl and hydroxyethyl radicals, R^4 is an alkylene radical having from about 2 to about 6 carbon atoms and R^5 is an alkyl radical having from about 10 to about 18 carbon atoms.

Representative amidosulfobetaine surfactants include cocoamidomethylsulfopropylbetaine, stearylamidodimethylsulfopropylbetaine, and laurylamidobis-(2-hydroxyethyl)-sulfopropylbetaine.

In preferred sulfobetaine surfactants, R^2 and R^3 are methyl. R^1 is preferably ethylene. R4 is preferably an alkylene radical having 2 to 4 carbon atoms. R^5 preferably is a straight chain. Convenient sources of alkyl radicals having from 10 to 18 carbon atoms are tallow fatty alcohol and coconut fatty alcohol. Particularly preferred amidosulfobetaines are hydroxysultaines such as cocamidopropyl hydroxysultaine, the formula of which is



where RCO represents the coconut acid radical. Cocamidopropylhydroxysultaine is available from Lonza Inc. as Lonzaine CS and Lonzaine JS and from Miranol as Mirataine CBS.

The betaine surfactants will generally be present in the compositions of the inventions at levels ranging from 2-13% by weight, preferably 3-9%.

By essentially binary active system, it is meant that no more than about 1% of surfactants other than the ether sulfate and amidobetaine or amidosulfobetaine are included.

The alkyl ether sulfate surfactants used in the present formulations have the formula:

$RO(CnH2nO)qSO_3X$

or

$RO(CnH(2n+1)O)qSO_3X$

where R is an alkyl or hydroxyalkyl group containing about 8 to about 18 carbon atoms, n is 2 or 3 and q can vary from 1 to about 30. Ether sulfates wherein R is from C_{12} to C_{15} are preferred. Preferably q ranges from 1 to 3, especially 3. n is preferably 2. X is a cation preferably selected from the group consisting of alkali metal, especially sodium and potassium, ions, alkaline earth metal, e.g., calcium and magnesium, ions, ammonium or substituted ammonium ions such as mono-, di- or triethanolammonium cations. Mixtures of cations may be used. Ammonium ions are especially preferred. The alkyl ether sulfates will generally be present in the compositions of the invention at levels of from 6 to 22%, preferably 6 to 20%, and especially 10 to 18%.

Neodol 25-3A (ex Shell), which includes an ether sulfate wherein R is a mixture of C_{12}-C_{15} alcohol, X is ammonium and the alcohols are ethoxylated with 3EO groups may be used as a source of the ether sulfates. Other sources of alkyl ether sulfates suitable for use in the compositions of the invention include Pareth 23-3 (ex Shell) which includes ammonium alkyl ether sulfates in which R is a mixture of C12 and C13 alcohols and wherein the alcohols are ethoxylated with 3 EO groups.

The total percent by weight of surfactants in the formulations of the invention is preferably no higher than 30%, more preferably no higher than 25%, especially up to 21%. Preferably the surfactants comprise at least 16% of the composition.

The hydrotropes used herein are preferably selected from the group consisting of alkanols and lower alkyl (C_1-C_3) benzene sulfonates and mixtures thereof. Alkanols containing from one to six carbon atoms, particularly ethyl alcohol, and mixtures thereof can be used as solvents. Isopropanol is another appropriate alcohol. The preferred lower alkyl benzene sulfonates are sodium and potassium xylene, toluene, and cumene sulfonates and mixtures thereof. Especially preferred hydrotrope systems for alkylamidobetaines comprise mixtures of ethyl alcohol and sodium xylene sulfonate. The preferred hydrotrope for al-

kylamidosulfobetaines is ethanol.

The hydrotropes can total from 1 to 12% by weight of the formulation. For sodium xylene sulfonate and other lower alkyl benzene sulfonate hydrotropes, the preferred range is from 0.5 to 3.5 wt%, preferably 1.5 to 3.5%. The preferred range for ethanol is from 1 to 10%, especially 3 to 8%.

Among the optional ingredients which may be present in the light duty liquid detergent compositions of the invention are neutral salts. Particularly preferred neutral salts include the alkali metal sulfates, particularly sodium sulfate, and the alkali metal chlorides, particularly sodium chloride. The neutral salts comprise from 0 to 12%, preferably from 0.5 to 12% of the present compositions. Sodium chloride is preferably present within the range of 0.25 to 2 wt% whereas sodium sulfate will generally be present at from 0 to 5 wt%, especially 0.25 to 5 wt %. Compositions may include both sodium chloride and sodium sulfate. Other examples of neutral salts which may be included in the formulations of the invention are sodium, potassium, ammonium, zinc, monoethanolammonium, diethanolammonium and triethanolammonium sulfates, chlorides, bromides, iodides, fornates, oretates, citrates, succinates and tartrates.

The compositions of the invention are formulated generally to have a viscosity of from 150 to 3500 cps. Where less ciscous liquids are desired, the viscosity will range from 150 up to 1000 cps, preferably 300-400 cps. The viscosity of high viscosity liquids will preferably be within the range of 1000-2500 cps, preferably about 2500 cps. The present invention yields an clear, stable, highly viscous liquid within the 1000-2500 cps range. Such higher viscosity formulations can be used advantageously in direct application washing wherein the liquid is applied to the dishware or utensil itself (e.g., squirted onto the utensil or onto a sponge and applied to the utensil) instead of after dilution with dishwater. In general, the viscosity of the compositions is adjusted by varying the levels of neutral salts and hydrotropes.

Water will generally comprise from 40 to 80% by weight of the compositions, preferably 49 to 77%.

The compositions of the invention may include various other ingredients typically found in light duty detergents including colorants and dyes such as D&C Yellow #10 and FD&C Green #3, perfumes and preservatives.

The pH of the compositions will generally range from 6 to 7.5, preferably about 7.

The compositions of the invention are stable and generally clear, although they may be opacified if desired.

The light duty liquid detergent of the invention does not generally include a polymeric surfactant, cationic polymers, a clay or an abrasive, although inclusion of such ingredients may be appropriate in certain circumstances. Also, the detergent of the invention does not include alkanolamide or amine oxide surfactants.

While the light duty liquid detergent compositions of the invention are primarily adapted to use as hand dishwashing detergents, their use is not limited thereto. For instance, it may be appropriate to utilize the formulations as shampoos, bubble bath compositions, liquid soaps and the like.

The compositions of the invention may be prepared in the following manner. The required amount of alkyl ether sulfate active solution is poured into a mixing vessel fitted with an overhead stirrer. With the mixer operating at high speed, any sodium xylene sulfonate solution is slowly added. Once the solution is homogeneous, water is slowly added to the center of the vortex to minimize gelation. If electrolyte is required in the formulation, it should be dissolved in the water beforehand.

Once all the water has been added, mixing is continued until no gel particles are visible. The betaine solution is then added with mixing, followed by any color and fragrance. The entire process is carried out at room temperature.

Unless otherwise indicated, all percentages given herein are by weight.

EXAMPLES

Example 1

The following dishwashing liquid was prepared in accordance with the process described above.

Component	% by weight
Ammonium C_{12}-C_{15} alcohol ethoxylated with 3 moles ethylene oxide, sulfated	15.4%
Cocoamidopropylbetaine	8.6%
Ethanol	3.9%
Sodium chloride	1.4%
Sodium xylene sulfonate	0.5%
Water, color, fragrance	to 100%

The viscosity of the product was 2000-2500 cps. The product was clear and stable.

Example 2

Mildness

An occlusive patch test was conducted to evaluate formulations for mildness potential. Ivory Liquid Dishwashing detergent was used as a standard. In the occlusive patch test, 2% solutions of a formulation are attached to the forearm using plastic discs. The discs are left on the arm for 24 hours, then the skin is evaluated 24 hours after removal of the discs. The lower the score, the less irritating the formulation. The following formulations were tested.

Component	A	B	C	D	E
Sodium lauryl sulfate	14	--	--	--	--
Ammonium C12-C15 alcohol + 3 EO, Sulfated (from Neodol 25-3A)	--	13.5	19	15	19
Cocoamidopropylbetaine	8	7.5	6	10	--
Cocoamidopropylhydroxysultaine	--	--	--	--	6
Ethanol	--	3.4	4.75	3.75	4.75
Sodium Chloride	1.3	1.25	1.0	1.67	0.85
Sodium xylene sulfonate	1.5	1.5	1.5	1.5	--
Water	75.2	72.85	67.75	68.08	69.40

Formulation	Irritation
A (Comparison)	1.233
B	0.6
C	0.6
D	0.633
E	0.6
Ivory Liquid	0.7

There are no significant differences between formulations B,C,D and E in accordance with the invention and Ivory Liquid.

Example 3

Dispersibility

A six foot clear tygon tube with an internal diameter of 3 cm was suspended vertically. The tube was calibrated, its end capped and filled with 40 degree C tap water. A 75 ul aliquot of light duty liquid was injected onto the water surface using a positive displacement pipette. The LDL droplet was followed visually and the point where the drop could no longer be seen was recorded. Three trials were performed for each LDL. Fresh 40 degree C tap water was used for each formulation. The larger the distance reported, the poorer the dispersability.

Component (wt%)	1	2	3	4	5
Ammonium C12-C15 alcohol ethoxylated with 3 moles	13.5	13.5	13.5	13.5	13.5
Ethylene oxide, sulfated cocoamidopropyl betaine	7.5	7.5	7.5	7.5	7.5
Ethanol	3.4	3.4	3.4	3.4	8.2
Sodium chloride	1.25	1.25	11.25	1.25	1.25
Sodium sulfate	--	4.0	--	8.0	--
Sodium xylene sulfonate	0.5	2.5	--	--	--
Water	73.85	67.85	64.35	66.35	69.55
Viscosity (cps)	2000	2000	2000	2000	2000

Formulation	Dispersion Distance (inches)
1	32
2	35
3	did not disperse
4	did not disperse
5	30
Commercial Dishwashing Liquid I	33
Commercial Dishwashing Liquid II	49

Viscosities were measured with a Brookfield viscometer using a number 3 spindle. This example demonstrates the preferred embod iment of a high viscosity LES/betaine mixture which possesses dispersability equal to that of marketed products. The higher viscosity provides an advantage in direct application washing. Formulations 1, 2 and 5 containing sufficient hydrotrope such that the LDL is dispersed in this test are preferred. It is especially preferred that the LDL disperse within 40, preferably within 35, inches in this test.

Example 4

Piston Plunger Test

The piston plunger is used to determine the relative abilities of LDLs to resist foam depletion in the presence of food soil. In the test, foam is generated and food soil is added in 10 gram increments. The agitation/soil addition cycles continue until the foam is depleted. The weight of the soil added is then determined and used as a relative measure of LDL efficacy.

Crisco Shortening Soil	Ragu Spaghetti Soil
A Food Soil Including Crisco Shortening	A Food Soil Including Ragu Spaghetti Sauce

Example of Cleaning Performance I

The piston plunger method using the Ragu spaghetti soil was utilized to determine the performance of the following formulations. The experiments were conducted at 40 ° C.

Component	1	2
Ammonium C_{12}-C_{15} alcohol 3EO, sulfated	13.5%	19.3%
Cocoamidopropylbetaine	7.5	10.7%
Ethanol	3.40%	4.9%
Sodium chloride	1.25%	1.8%
Sodium xylene sulfonate	0.5	0.7%
Water	73.85%	62.9%

Formulation	Trial 1	Trial 2	Trial 3
1	384g	428g	356g
2	435g	533g	405g
Commercial Dishwashing Liquid I	363g	380g	289g
Commercial Dishwashing Liquid II	422g	463g	371g

The performance of formulation 1 (21% total active) is superior to that of Commercial Dishwashing Liquid I. The performance of formulation 2 (30% total active) is superior to that of Commercial Dishwashing Liquid II. Both Commercial Dishwashing Liquid I and Commercial Dishwashing Liquid II Liquids contain greater than 30% total actives.

Cleaning Performance II

Effect of LES/betaine Ratio

Evaluation was via piston plunger using Ragu® spaghetti sauce soil. The experiment was conducted at 40 ° C.

Component	1	2	3	4
Ammonium C_{12}-C_{15} alcohol 3 EO, sulfated	19.5%	16.5%	13.5%	10.5%
Cocoamidopropylbetaine	1.5%	4.5%	7.5%	10.5%
Ethanol	4.9%	4.15%	3.4%	2.6%
Sodium chloride	0.25%	0.75%	1.25%	1.75%
Sodium sulfate	4.0%	4.0%	4.0%	4.0%
Sodium xylene sulfonate	1.5%	1.5%	1.5%	1.5%
Water	68.35%	68.6%	68.85%	69.15%

Formulation	Trial 1	Trial 2	Trial 3
1	246g	280g	264g
2	317g	351g	342g
3	339g	341g	386g
4	321g	362g	372g
Ivory Liquid Detergent	383g	429g	425g
Commercial Dishwashing Liquid II	370g	403g	413g
Commercial Dishwashing Liquid I	313g	320g	326g

At a ratio of 4 LES/1 betaine and a total of 21% actives, equal performance to Commercial Dishwashing Liquid I is attained. At smaller ratios of LES/betaine (below 2:1), and a total actives content of 21%, superior performance to Commercial Dishwashing Liquid I was observed.

Cleaning Performance III

Comparison of 24% total active formulations to Ivory (R) Liquid (33-34% total actives). The piston plunger test using the Crisco (R) shortening soil at 40 degrees C was used.

Component	1	2	3
Ammonium C_{12}-C_{15} alcohol 3 EO, sulfated	15.4%	18.0%	15.4%
Cocoamidopropylbetaine	8.6%	6.0%	--
Cocoamidopropylhydroxysultaine	--	--	8.5%
Ethanol	3.8%	4.6%	3.8%
Sodium chloride	1.4%	1.15%	1.0%
Sodium sulfate	4.6%	4.0%	1.0%
Sodium xylene sulfonate	1.7%	1.5%	--
Water	64.5%	64.75%	70.2%
Viscosity (cps)	2000	2000	2000

Formulation	Weight of Soil to Deplete Foam
1	247g
2	239g
3	237g
Ivory Liquid Detergent	250g

Cleaning Performance IV

The plates washing test was used to evaluate the exampiles from "Cleaning Performance III".

Plates Washing Test

Soiled dishes are prepared by spreading 5 mls of Crisco (R) shortening soil on each dish with a spatula. They are then stacked. Meanwhile, water containing the appropriate amount of hardness is heated

to 115 degrees F.

One gallon of the warm water is added to a wash basin along with the appropriate amount of LDL. Foam is then generated by using a Mixette electric hand mixer at high speeds for 20 seconds.

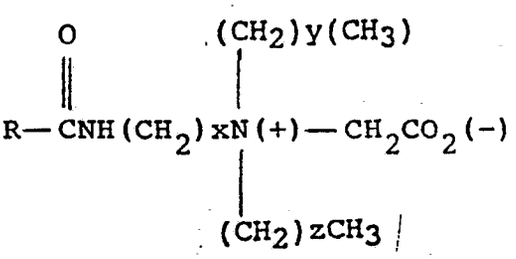
Plates washing then proceeds using a standard wash cloth and washing regime. The operator submerges the plate and washes the front surface with six circular stokes. The plate is inverted, and the back surface is washed with three circular strokes. The plate is then removed from the wash solution, tipped against the basin's edge at a 45 degree angle for 3 seconds (to allow foam drainage), and stacked. The process continues until half the water's surface is no longer covered with foam, as judged by an independent observer. The number of plates washed is then counted and used as a relative measure of performance.

Formulation	Plates Washed
1	36
2	33
3	31
Ivory Liquid	34

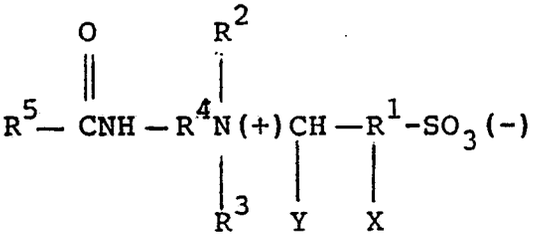
Both the piston plunger and plates washing test demonstrate that the preferred embodiment at 24% total actives level provides parity performance to a leading product containing 34% total actives.

Claims

1. An aqueous liquid detergent comprising
a) an essentially binary active system consisting of
(i) a betaine surfactant selected from:
A) alkylamidobetaines having the formula:



where R is an alkyl or alkenyl chain containing 9 to 17 carbon atoms, x is an integer of 2 to 4, y is an integer of 0 to 3 and z is an integer of 0 to 3 and
B) alkylamidosulfobetaines of formula:



wherein R^1 is an alkylene radical having from 1 to about 3 carbon atoms, X is hydrogen, methyl or hydroxy, Y is hydrogen or methyl, R^2 and R^3 are each independently selected from methyl, ethyl and hydroxyethyl radicals, R^4 is an alkylene radical having from about 2 to about 6 carbon atoms and R^5 is an alkyl radical

having from about 10 to about 18 carbon atoms, and mixtures thereof and
(ii) an alkyl ether sulfate surfactant of formula:
$RO(CnH2n0)q\text{-}S0_3X$ or
$RO(CnH(2n+1)0)q\text{-}S0_3X$
wherein R is higher alkyl group of from 8 to 18 carbon atoms, X is a member selected from the group consisting of alkali metal ions, alkaline earth metal ions, ammonium ions and ammonium ions substituted with from one to three lower alkyl or alkanol groups and q is from 1 to 3, and mixtures thereof, the weight ratio of (i) to (ii) being in the range of 1:4 to 1:1,
b) from 1 to 12% by weight of a hydrotrope,
c) from 0 to 12% by weight of electrolytes and
d) water.

2. A composition as claimed in claim 1, wherein the alkyl ether sulfate salt is an ammonium salt.

3. A composition as claimed in claim 1 or claim 2 wherein the hydrotrope is selected from ethanol, isopropanol, C_1 and C_3 aromatic sulfonates and urea.

4. A composition as claimed in any one of claims 1 to 3 wherein the alkyl ether sulfate is a liner alkyl ether sulfate.

5. A composition as claimed in any one of claims 1 to 4 wherein the weight ratio of (i) to (ii) is from about 1:3 to about 1:1.5.

6. A composition as claimed in any one of claims 1 to 5 wherein the betaine surfactant is present at from 2 to 13% by weight.

7. A composition as claimed in any one of claims 1 to 6 wherein the alkyl ether sulfate is present at from 6 to 22% by weight.

8. A composition as claimed in any one of claims 1 to 7 comprising no greater than 30% total surfactant.

9. A composition as claimed in any one of claims 1 to 8 wherein the electrolytes are selected from neutral salts of the group of sodium chloride, sodium sulfate and mixtures thereof.

10. A method for the preparation of a composition according to any one of claims 1 to 9 which comprises mixing together the surfactants, hydrotrope and an appropriate quantity of water.