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(71) Applicant:

**Cognis Deutschland GmbH
40589 Düsseldorf (DE)**

(72) Inventors:

- **Elsner, Michael
42967 Solingen (DE)**
- **Herd, Helen Elizabeth
Bacup, OL13 8BT, Lancashire (GB)**

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(54) **Detergent formulation**

(57) A liquid detergent formulation comprising for use as a "hard surface" cleaner comprises, 5-10% of an alkyl (C₈₋₂₂) sulphate, 5-10% of an alkyl (C₈₋₂₂) ether sulphate, 0-3% of an amine oxide containing at least one C₈₋₂₂ alkyl group, 1-6% of an amphoteric betaine surfactant containing at least one C₈₋₂₂ alkyl group, 2-10% of an ethoxylated alcohol (C₈₋₂₂), 2.5-9% of an alkyl (C₈₋₂₂) polyglycoside and a balance of water.

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Description

[0001] The present invention relates to a detergent formulation intended particularly but not exclusively as a so-called "washing up" liquid for use in washing crockery, cutlery, pans and other domestic utensils which have been used in the preparation and/or consumption of food and which have deposits of dirt, food, grease, burnt residues etc. The detergent formulation is also intended, not exclusively, as a "hard surface" cleaner.

[0002] Purchasers of "washing up" cleaning liquids generally regard two particular properties as being of importance. One is that a relatively small quantity of the liquid will suffice for washing a particular number of utensils. In other words, the purchasers like to feel that the liquid is economical to use. The other property is that the liquid generates a relatively large volume of suds (i.e. the liquid has good lathering characteristics) since it is generally assumed that such suds contribute to the efficiency of the liquid.

[0003] GB-A-2 290 301 discloses "washing-up" liquid having good cleaning and lathering performance without the use of LABS (linear alkyl benzene sulphonic acid - usually used as the sodium salt) or diethanolamides (which are associated with nitrosamines). GB-A-2 321 253 also discloses "washing-up" liquid, containing 10-20wt% of an alkyl sulphate, 1-10wt% of an alkyl ether sulphate, 1-7wt% of an amine oxide, 1-7wt% of an amphoteric betaine surfactant, 1-15wt% of an ethoxylated alcohol and up to 3wt% of an alkyl polyglycoside, although only up to 0.95wt% of the alkyl polyglycoside is specifically used. The present invention aims to provide detergent formulations demonstrating improved performance.

[0004] According to the present invention there is provided a liquid detergent formulation comprising, by weight, 5-10% of an alkyl (C₈₋₂₂) sulphate, 5-10% of an alkyl (C₈₋₂₂) ether sulphate, 0-3% of an amine oxide containing at least one C₈₋₂₂ alkyl group, 1-6% of an amphoteric betaine surfactant containing at least one C₈₋₂₂ alkyl group, 2-10% of an ethoxylated alcohol (C₈₋₂₂), 2.5-9% of an alkyl (C₈₋₂₂) polyglycoside and a balance of water.

[0005] It has been found that a liquid detergent in accordance with the present invention has excellent cleaning properties. In particular the liquid detergent provides an outstanding foam height, which persists for a long time both on standing and in washing greasy plates, both properties being desirable to the user. More importantly the liquid detergent is not only effective at removing greasy deposits from hard surfaces but also for retaining said grease particles in solution stopping them from being re-deposited.

[0006] This result shows a surprising improvement over the disclosure contained within GB-A-2 321 253. It is proposed that this improvement is due to the higher amount of polyglycoside.

[0007] The composition of the invention includes at least one C₈₋₂₂ alkyl sulphate used in an amount of 5-10% by weight of the formulation, more preferably 8-10% and most preferably 9-10%.

[0008] The invention is particularly beneficial with the use of an amount of alkyl (C₈₋₂₂) sulphate lower than that disclosed in GB-A-2 321 253. In particular, the benefits of the invention may be obtained with the use of less than 10% by weight of alkyl (C₈₋₂₂) sulphate, particularly in the range of 8% to less than 10%.

[0009] The alkyl sulphate is preferably an alkali metal alkyl sulphate with the preferred alkali metal being sodium.

[0010] For preference, the alkyl group of the alkyl sulphate has 8-16 carbon atoms. The alkyl sulphate may be a single compound (preferably C₁₂) or may comprise a mixture of alkyl sulphates of different chain lengths, preferably with C₁₂ predominating. For preference the alkyl groups are primary alkyl groups and preferably straight chain.

[0011] The carbon chain of the alkyl sulphate may be produced synthetically or may be derived from natural products (e.g. coconut oil) so that the chain length distribution of the alkyl group will correspond to that in the natural product from which it is derived.

[0012] The alkyl sulphate may be a "narrow cut" lauryl sulphate having carbon chains principally of C₁₂ to C₁₄ (C₁₂ predominating), e.g. 60-70% C₁₂, 20-30% C₁₄ plus minor amounts of C₁₀ and C₁₆.

[0013] A preferred alkyl sulphate is available under the name Empicol LX28 (Albright & Wilson).

[0014] The alkyl (C₈₋₂₂) ether sulphate is preferably used in an amount of 5-10%, by weight of the formulation, more preferably 6-9% and most preferably 7-8%.

[0015] The invention is particularly beneficial with the use of an amount of alkyl (C₈₋₂₂) ether sulphate lower than that disclosed in GB-A-2 321 253. In particular, the benefits of the invention may be obtained with the use of less than 8% by weight of alkyl (C₈₋₂₂) ether sulphate, particularly in the range of 7% to less than 8%.

[0016] The cation present in this material may, for example, be an alkali metal (particularly sodium) or ammonium. It is particularly preferred that the alkyl ether sulphate be an alkyl (C₈₋₂₂) ethoxylated (n = 1 to 5, preferably 2 or 3) sulphate.

[0017] The alkyl group of the ether sulphate may be as described for the alkyl sulphate.

[0018] The most preferred alkyl ether sulphate for use in the invention is sodium lauryl ether sulphate where n = 2 or 3.

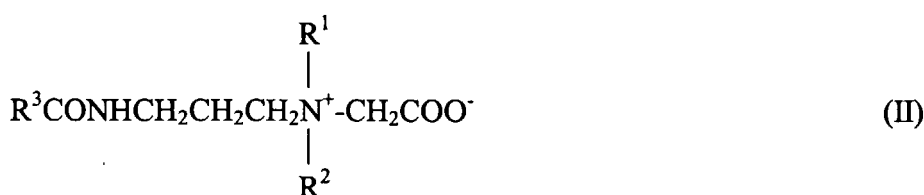
[0019] An alkyl ether sulphate which may be used is available under the name Empicol 0251 (Albright & Wilson).

[0020] The formulation of the invention contains 0 to 3%, more preferably 1 to 3%, of an amine oxide containing at least one C₈₋₂₂ alkyl group. The amine oxide preferably has one such group of C₈₋₂₂ carbon atoms and two C₁₋₄ alkyl

groups. Most preferably the latter alkyl groups are methyl groups. Preferred amine oxides are therefore (C₈₋₂₂) alkyl dimethyl amine oxides. The long chain alkyl group may, for example, have 8-18 carbon atoms and the compound may comprise a mixture of alkyl groups, which are preferably C₁₀ to C₁₈ (with C₁₂ predominating).

[0021] A suitable amine oxide is available under the name Genaminox CSX (Hoechst).

[0022] The betaine surfactant is used in the formulation of the invention in an amount of 1-6%, more preferably 0.5-4%. Preferred betaines may be either of the formula (I) or (II).



[0023] In the above formula, R¹ and R² may be the same or different C₁₋₄ alkyl groups whereas R³ is an alkyl group having 8-22 carbon atoms, e.g. mixed C₁₀ to C₁₄.

[0024] The preferred betaine for use in the formulation of the invention is cocoamidopropyl betaine.

[0025] A suitable betaine is available under the name Rewoteric AMB14 (Witco).

[0026] A further component of the formulation of the invention is the ethoxylated alkanol (C₈₋₂₂) which is used in an amount of 2-10%, more preferably 2-9% and most preferably 2-7%.

[0027] Examples of such ethoxylated alkanols which may be used are those in which the alkanol (from which the product is derived) is a primary alcohol and is preferably linear. Preferably the alkanol has 6 to 11 carbon atoms (e.g. mixed C₉-C₁₁) and in which the degree of ethoxylation is 5-15 (particularly 8-10).

[0028] A suitable fatty alcohol ethoxylate is available under the name Lutensol ON80 (BASF).

[0029] The formulations of the invention contains 2.5-9% alkyl (C₈₋₂₂) polyglycoside by weight. It is known by those skilled in the art that a glycoside is a sugar derivative, wherein one or more of the hydroxyl functions, which may preferably be on the first carbon atom of the sugar molecule, is/are replaced by another group such as an alcoholic or phenolic group. It is also known that such functionalised sugar molecules may be linked to one or more other sugar molecules, either before or after functionalisation, to form a polyglycoside. The preferred glycoside employed in the present invention is a glucoside (i.e. based on glucose), functionalised with a primary alcohol (e.g. C₁₂-C₁₄). More preferably the glucoside is in the form of a polyglucoside, with a preferable average degree of polymerisation of between 1-2, most preferably about 1.4.

[0030] A suitable polyglycoside is available under the name Glucopan 600CSUP (Henkel).

[0031] A further optional component which may be used in the formulation of the invention is a hydrotrope which may be used in an amount up to 7%, e.g. 3%, of the formulation. A particular preferred hydrotrope is sodium xylene sulphonate.

[0032] The formulation may contain the usual minor addition such as preservatives, dyes and/or perfumes.

[0033] The invention will be illustrated with reference to the following non-limiting Examples.

Examples

[0034] Formulations A to K were prepared as shown below.

% by Weight											
	A	B	C	D	E	F	G	H	I	J	K
Sodium Lauryl Sulphate (Empicol L28)	9.6	9.6	9.6	9.6	9.6	9.6	9.6	9.6	9.6	9.6	9.6
Sodium Lauryl Ether Sulphate (Empicol 0251)	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.8
Fatty Alcohol Ethoxylate (Lutensol ON80)	-	12.0	4.0	2.0	-	6.0	8.0	-	6.0	2.0	5.0
Cocoamidopropyl Betaine (Rewoteric AMB14)	6.0	-	4.0	2.0	12.0	-	2.0	-	6.0	8.0	3.0
Alkyl Polyglycoside (Glucopon 600CSUP)	6.0	-	4.0	8.0	-	6.0	2.0	12.0	-	2.0	3.2
Sodium Xylene Sulphonate	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Preservatives, Dyes, Perfumes	Minor Additions										
Water	To 100										

[0035] In the above table, the percentages represent amount of active material. It should be noted that only formulations C,D and K were prepared in accordance with the present invention. Formulations A,B and E to J were prepared as comparative examples.

[0036] The above formulations were compared for their effectiveness in preventing oily soil being re-deposited on clean surfaces by a plate washing test.

[0037] The plate washing test was a standard test used to determine the number of plates which could be washed using a predetermined quantity (0.2g/litre) of the detergent formulation. The plates had each been soiled with 2 ml of melted lard, which contained a red dye (Red number 17 90095 available from Ellis and Everard) for ease of visibility on the white plates and which was applied in the form of small drops and then allowed to harden for 24 hours. For each formulation test 25 such plates were prepared.

[0038] The plates were washed one at a time in a 5 litre bowl of water, which had been pre-heated to 50°C and which contained 0.2g/litre of detergent formulation. The washing was stopped when the foam produced by the formulation no longer covered the surface of the water. After washing the plates were assessed for cleanliness, being divided into three categories, as follows:

- 1) Not cleaned at all, i.e. not washed because the foam no longer covered the surface of the water in the bowl.
- 2) Superficially clean but observed to be slightly soiled upon close examination.
- 3) Totally clean.

[0039] The above formulations were tested using the plate washing test as described above.

1) Standard Platewash (Lard Soil)

[0040]

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Platewash (Lard soil)											
	A	B	C	D	E	F	G	H	I	J	K
Number of Plates not cleaned	3	15	3	2	3	7	6	4	3	3	2
Number of Plates superficially clean	12	3	6	6	9	3	7	6	9	14	4

(continued)

Platewash (Lard soil)											
	A	B	C	D	E	F	G	H	I	J	K
Number of Plates cleaned	10	7	16	17	13	15	12	15	13	14	19

[0041] Formulations C,D and K not only were observed to clean the highest number of plates but also demonstrated a relatively low number of superficially clean plates. Both properties are of utmost importance to the user.

[0042] Formulations A (lacking the fatty alcohol ethoxylate), E (lacking fatty alcohol ethoxylate and the polyglycoside) and H (lacking the fatty alcohol ethoxylate and betaine) performed considerably worse, leading to a lower number of plates cleaned and an equal or higher number of superficially clean plates. Formulation B (lacking the polyglycoside) performed worse still, leading to a very high number of dirty plates.

[0043] Similarly formulations G, I, J (not containing enough of the polyglycoside) and F (lacking the betaine) did not perform as effectively as formulations C,D and K.

[0044] Formulations A1 to A7 were prepared as shown in the table below

% by Weight							
	A1	A2	A3	A4	A5	A6	A7
Sodium Lauryl Sulphate (Empicol L28)	6.8	9.6	9.6	6.8	9.6	9.6	16
Sodium Lauryl Ether Sulphate (Empicol 0251)	5.2	7.4	7.4	5.2	7.4	7.4	2.0
Fatty Alcohol Ethoxylate (Lutensol ON80)	6.0	4.64	4.38	6.0	4.64	4.38	8.5
Cocoamidopropyl Betaine (Rewoteric AMB14)	6.0	4.3	5.93	5.4	4.1	4.5	2.1
Alkyl Polyglycoside (Glucopon 600CSUP)	4.0	3.06	1.69	4.5	3.25	2.75	0.05
Sodium Xylene Sulphonate	2.5	2.5	2.5	1.8	2.0	1.8	2.2
Formalin	0.04	0.04	0.04	0.04	0.04	0.04	0.04
Preservatives, Dyes, Perfumes	Minor Additions						
Water	To 100						

[0045] In the above table, the percentages represent amount of active material. It should be noted that formulations A1-A2 and A4-A5 were prepared in accordance with the present invention. Formulations A3,A6 and A7 were prepared as comparative examples.

[0046] The above formulations were tested using the plate washing test as described above.

1) Standard Platewash (Lard Soil)

[0047]

Platewash (Lard soil)			
	A1	A2	A3
Number of Plates not cleaned	1	2	1
Number of Plates superficially clean	13	13	16
Number of Plates cleaned	11	10	8

[0048] Formulations A1 and A2 were observed to clean the highest number of plates but also demonstrated the lowest number of superficially clean plates.

[0049] Formulation A3 did not contain enough of the polyglycoside to perform as effectively as formulations A1 and A2.

[0050] The above formulations were also tested using a mixed soil plate washing test. In this test 3 grams of food residue, comprising 40% potato, 30% lard, 10% egg and 20% minced beef by weight, was applied to each plate and allowed to harden for 24 hours.

[0051] The plates were washed as in the lard soil platewash and assessed for cleanliness using the same criteria.

2) Mixed Soil Platewash

[0052]

Platewash (Mixed Soil)				
	A4	A5	A6	A7
Number of Plates not cleaned	6	6	7	9
Number of Plates superficially clean	-	-	-	-
Number of Plates cleaned	19	19	18	16

[0053] Formulations A6 and A7 performed worse than formulations A4 and A5, as a result of lower polyglycoside content even though the formulations A6 and A7 had an equal if not considerably greater concentration of sodium lauryl sulphate.

3) Foam Heights

[0054] The lathering performance was judged by a standard test in which 200 ml of a 1% solution of the formulation is drained into a measuring cylinder from a separating funnel positioned 75 cm above the base of the cylinder. The height of the lather produced after 1 minute and after 30 minutes was measured.

[0055] The results of the foam height testing are shown in the table below.

Foam Height (mm)			
	A1	A2	A3
Initial	123	120	115
After 30 minutes	117	116	110

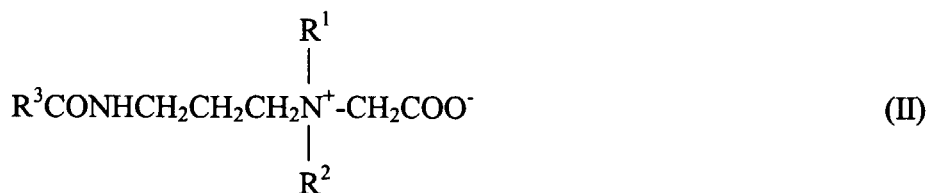
[0056] This consideration is also very important to the user. Formulation A3 produced a significantly lower foam than formulations A1 and A2 in both parts of the test, as a result of a lower polyglycoside content.

[0057] It will be appreciated from the information presented above that formulations in accordance with the invention are of considerably improved performance as compared to the prior art.

Claims

1. A liquid detergent formulation comprising, by weight, 5-10% of an alkyl (C₈₋₂₂) sulphate, 5-10% of an alkyl (C₈₋₂₂) ether sulphate, 0-3% of an amine oxide containing at least one C₈₋₂₂ alkyl group, 1-6% of an amphoteric betaine surfactant containing at least one C₈₋₂₂ alkyl group, 2-10% of an ethoxylated alcohol (C₈₋₂₂), 2.5-9% of an alkyl (C₈₋₂₂) polyglycoside and a balance of water.
2. A formulation as claimed in claim 1 wherein the alkyl sulphate is present in an amount of 8-10% by weight, preferably 9-10%.
3. A formulation as claimed in claim 1 or 2 wherein the alkyl sulphate is an alkali metal alkyl sulphate.

4. A formulation as claimed in claim 3 wherein the alkali metal is sodium.
5. A formulation as claimed in any one of claims 1 to 4 wherein the alkyl group of the alkyl sulphate has 8-16 carbon atoms.
6. A formulation as claimed in claim 5 wherein the alkyl sulphate is or is predominantly a lauryl sulphate.
7. A formulation as claimed in any one of claims 1 to 6 wherein the alkyl ether sulphate is present in an amount of 6-9% by weight.
8. A formulation as claimed in claim 7 wherein the alkyl ether sulphate is present in an amount of 7-8% by weight
9. A formulation as claimed in any one of claims 1 to 8 wherein the cation of the alkyl ether sulphate is an alkali metal (preferably sodium) or ammonium.
10. A formulation as claimed in any one of claims 1 to 9 wherein the alkyl ether sulphate is an alkyl ethoxylated sulphate.
11. A formulation as claimed in claim 10 wherein the alkyl ethoxylated sulphate has 1 to 5 units of ethoxylation.
12. A formulation as claimed in claim 11 wherein the alkyl ethoxylated sulphate has 2 or 3 units of ethoxylation.
13. A formulation as claimed in claim 12 wherein the alkyl ether sulphate is sodium lauryl ether sulphate.
14. A formulation as claimed in any one of claims 1 to 13 containing 1 to 3% of the amine oxide.
15. A formulation as claimed in any one of claims 1 to 14 wherein the amine oxide has one alkyl group of C₈₋₂₂ carbon atoms and two C₁₋₄ alkyl groups.
16. A formulation as claimed in claim 15 wherein the amine oxide is a (C₈₋₂₂) alkyl dimethyl amine oxide.
17. A formulation as claimed in any one of claims 1 to 16 wherein the betaine surfactant is present in an amount of 0.5 to 4% by weight.
18. A formulation as claimed in any one of claims 1 to 17 wherein the betaine is of the formula



in which R¹ and R² may be the same or different C₁₋₄ alkyl groups and R³ is an alkyl group having 8-22 carbon atoms.

19. A formulation as claimed in claim 18 wherein the betaine is cocoamidopropyl betaine.

20. A formulation as claimed in any one of claims 1 to 19 wherein the ethoxylated alcohol is present in an amount of 2-9% by weight
- 5 21. A formulation as claimed in claim 20 wherein the ethoxylated alcohol is present in an amount of 2-7% by weight.
22. A formulation as claimed in any one of claims 1 to 21 wherein the alkanol from which the ethoxylated alkanol is derived is linear.
- 10 23. A formulation as claimed in any one of claims 1 to 22 wherein the alkanol from which the ethoxylated alkanol is derived has 6 to 11 carbon atoms.
24. A formulation as claimed in any one of claims 1 to 23 in which the degree of ethoxylation in the ethoxylated alkanol is 5-15.
- 15 25. A formulation as claimed in claim 24 wherein said degree of ethoxylation is 8-10.
26. A formulation as claimed in any one of claims 1 to 25 wherein the alkyl (C₈₋₂₂) polyglycoside is a polymer of glucose having a degree of polymerisation between 1 to 2.
- 20 27. A formulation as claimed in claim 26 wherein the alkyl (C₈₋₂₂) polyglycoside is a polymer of glucose having a degree of polymerisation of about 1.4.
28. A formulation as claimed in any one of claims 1 to 27 additionally containing a hydrotrope.
- 25 29. A formulation as claimed in claim 28 wherein the hydrotrope is present in an amount up to 7% by weight.
30. A formulation as claimed in claim 28 or 29 wherein the hydrotrope is sodium xylene sulphonate.
- 30 31. A liquid detergent formulation comprising, by weight, less than 10% of an alkyl (C₈₋₂₂) sulphate, 7-8% of an alkyl (C₈₋₂₂) ether sulphate, 0-3% of an amine oxide containing at least one C₈₋₂₂ alkyl group, 1-6% of an amphoteric betaine surfactant containing at least one C₈₋₂₂ alkyl group, 2-10% of an ethoxylated alcohol (C₈₋₂₂), 2.5-9% of an alkyl (C₈₋₂₂) polyglycoside and a balance of water
- 35 32. A formulation as claimed in claim 31 wherein the alkyl (C₈₋₂₂) polyglycoside is present in an amount greater than 3% by weight.
33. A formulation as claimed in claim 32 wherein the alkyl (C₈₋₂₂) polyglycoside is present in an amount greater than 3.5% by weight.