

LIQUID DETERGENT COMPOSITION

This invention relates to a liquid detergent possessing an excellent detergency and abundant foaming ability. The detergent is particularly suitable for use in washing dishes
5 and other tablewares.

Detergency and foaming ability are the most basic properties which a household detergent composition is supposed to possess. It is commonly accepted that there are no special relations between the foaming ability and
10 detergency. Thus, a detergent possessing an excellent detergency is not necessarily one possessing a good foaming ability.

Most consumers, however, very frequently relate detergency with foaming ability, and tend to favor a
15 detergent that produces abundant foam. For this reason, a detergent possessing both excellent detergency and foaming ability is favored as a commodity.

Conventional detergent compositions comprise an anionic surface active agent as a major detergent component,
20 primarily for affording foaming ability, and a nitrogen-containing amphoteric or non-ionic surface active agent such as tert-amine oxides, higher fatty acid alkanol amides and

alkyl betains, for imparting detergency or supplementing the foaming ability when they are used to wash out oily stains.

Although conventional detergents using an anionic surface active agent and a nitrogen-containing amphoteric or non-ionic surface active agent in combination exhibit detergency and foaming ability of a certain level at a relatively high concentration of more than 1%; at a lower concentration, i.e. at less than 1%, their detergency for oily stains is deficient, and moreover the stains once removed, tend to attach again to the object being washed.

In recent years, consumers have become inclined to use detergents at a lower concentration in order to prevent their hands from getting roughened. A lower concentration is also favorable from the economical point of view.

There has been therefore a strong desire for the development of a liquid detergent exhibiting an excellent detergency and foaming ability at a low concentration.

The inventors have made extensive studies to resolve these problems in conventional detergents, and as a result, it was found that a liquid detergent composition exhibiting an excellent detergency and foaming ability at a low concentration, e.g. at less than 1%, could be obtained by adding a specific polyoxyalkylene addition type non-ionic surface active agent to a detergent composition containing an anionic surface active agent and a nitrogen-containing

amphoteric or non-ionic surface active agent in combination. Such a finding has led to the completion of this invention.

5 Accordingly, an object of this invention is to provide a liquid detergent composition comprising:

(A) from 10 to 40% by weight of a synthesized anionic surface active agent,

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(B) from 1 to 10% by weight of a nitrogen-containing amphoteric or non-ionic surface active agent, and

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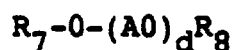
(C) from 0.5 to 10% by weight of a nitrogen-free polyoxyalkylene addition type non-ionic surface active agent having from 50 to 300 oxyalkylene groups per molecule;

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wherein said component (C) comprises at least one compound selected from the following:-

(i) a polyoxyalkylene alkyl- or alkenyl ether, or polyoxyalkylene fatty acid ester represented by the following formula (VI):-

25



(VI)

5 in which R_7 represents an alkyl-, alkenyl- or acyl group having from 10 to 24 carbons, R_8 represents an alkyl, alkenyl- or acyl group having from 10 to 24 carbons or a hydrogen atom, A represents an ethylene or propylene group, and d is a value of from 50 - 135 or 137-300;

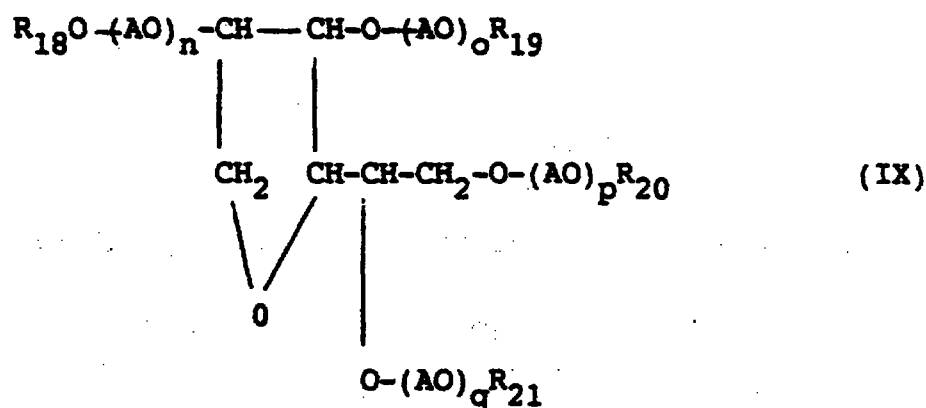
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(ii) a polyoxyalkylene glycerol alkyl- or alkenyl-ether;

(iii) a polyoxyalkylene glycerol fatty acid ester;

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(iv) a polyoxyalkylene sorbitan alkyl- or alkenyl ether, or a polyoxyalkylene sorbitan fatty acid ester represented by the following formula (IX):



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in which each of R_{18} , R_{19} , R_{20} and R_{21} independently represents an alkyl-, alkenyl- or acyl group having from 10 to 24 carbon atoms or a hydrogen atom, provided that at least one of R_{18} , R_{19} , R_{20} and R_{21} is an alkyl, alkenyl or acyl group, A represents an ethylene or propylene group, and each of n, o, p and q independently represents a value of from 0 to 100, provided that the sum of n, o, p, and q is from 50 to 300.

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(v) a polyoxyalkylene sorbitol alkyl- or alkenyl ether;

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(vi) a polyoxyalkylene sorbitol fatty acid ester; or

(vii) a polyoxyalkylene castor oil or a polyoxyalkylene hydrogenated castor oil.

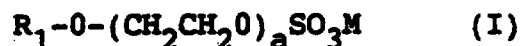
DETAILED DESCRIPTION OF THE INVENTION AND

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PREFERRED EMBODIMENTS

The component (A) to be used in the composition of this invention includes polyoxyethylene alkyl- or alkenyl ether sulfates, alkylbenzenesulfonates, 10 polyoxyethylene alkyl- or alkenyl ether acetates, α -olefin, sulfonates, alkane sulfonates, salts of α -sulfofatty acid esters, and the like. Among these compounds, polyoxyethylene alkyl- or alkenyl sulfates are preferable in view of mildness to the 15 skin and alkylbenzenesulfonates are preferable in view of detergency and cost. More specific examples of these preferable synthesized anionic surface active agents may be illustrated as follows.

20 Polyoxyethylene alkyl- or alkenyl ether sulfates may be the compounds represented by the following formula (I):



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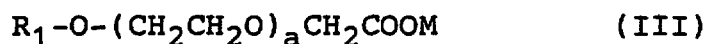
in which R_1 represents an alkyl- or alkenyl group having from 10 to 24 carbon atoms, a is a value of from 1 to 5, M represents an alkali metal, ammonium or an alkanolamine group.

- 5 Alkylbenzenesulfonates may be the compounds represented by the following formula (II):



- 10 in which R_2 represents an alkyl group having from 8 to 20 carbon atoms and M has the same meaning as defined above.

Polyoxyethylene alkyl- or alkenyl ether acetates may be the compounds represented by the following formula (III):

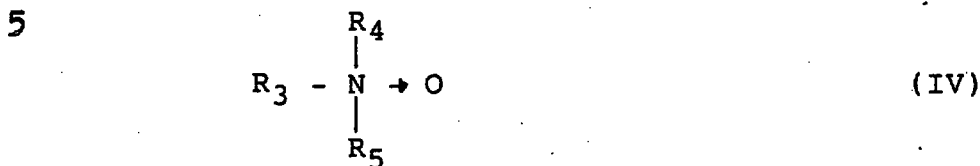


- 15 in which R_1 , a and M each has the same meaning as defined above.

Salts of α -olefin sulfonic acid and alkane sulfonic acid may be those compounds having from 10 to 24 carbon atoms, and salts of α -sulfofatty acid esters may be those 20 compounds which are derived from fatty acids having from 10 to 24 carbon atoms.

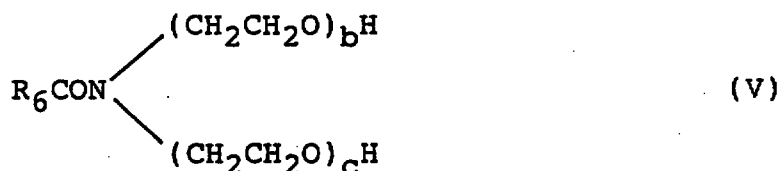
Although there is no specific limitation to the Component (B), the nitrogen-containing non-ionic or amphoteric surface active agent, so long as the same has a 25 good solubility with the above component (A) to be employed, preferable compounds are mono long chained alkyl- or alkenyl

tert-amine oxides, or higher fatty acid alkanol amides or ethylene oxide adducts thereof. Mono long chained alkyl- or alkenyl tert-amine oxides may be, for example, the compounds represented by the following formula (IV):



in which R_3 represents an alkyl- or alkenyl group having from 10 to 18 carbon atoms, and R_4 and R_5 independently represent an alkyl groups having 1 or 2 carbon atoms,

Higher fatty acid alkanol amides or ethylene oxide adducts thereof may be the compounds represented by the following formula (V):



in which R_6 represents an alkyl- or alkenyl group having from 10 to 18 carbon atoms, b is a value of from 1 to 3 and c is a value of from 0 to 3.

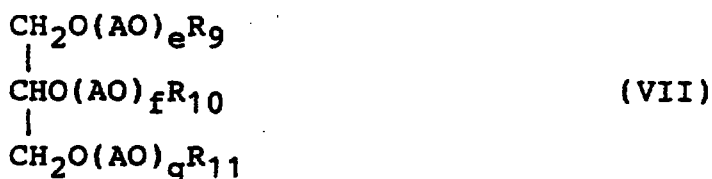
The following compounds (1) through (5) are given as examples of nitrogen-free polyoxyalkylene addition type non-ionic surface active agents having from 50 to 300 oxyalkylene groups per molecule, i.e. the component 20 (C):

(1) polyoxyalkylene alkyl- or alkenyl ethers and polyoxyalkylene fatty acid esters represented by the following formula (VI):



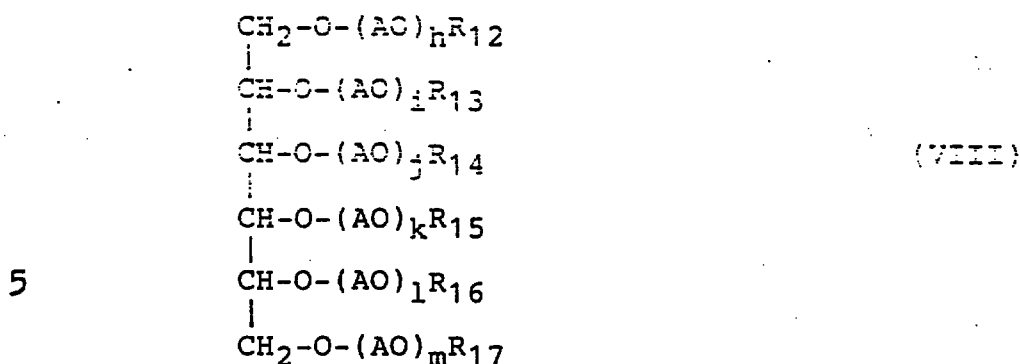
in which R_7 represents an alkyl-, alkenyl- or acyl group having from 10 to 24 carbon atoms, R_8 represents an alkyl-, alkenyl- or acyl group having from 10 to 24 carbon atoms or a hydrogen atom, A represents an ethylene or propylene group, and d is a value of from 50 to 300.

(2) polyoxyalkylene glycerol alkyl- or alkenyl ethers and polyoxyalkylene glycerol fatty acid esters represented by the following formula (VII):



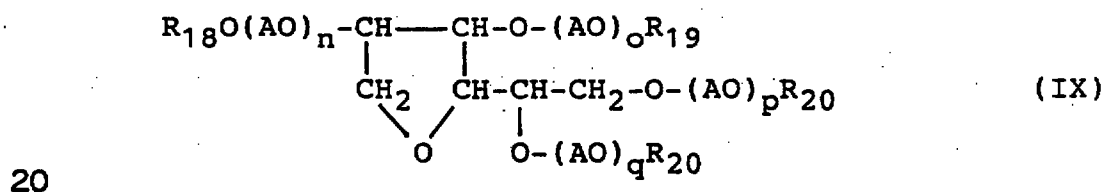
in which R_9 , R_{10} and R_{11} , each independently represents an alkyl-, alkenyl- or acyl group having from 10 to 24 carbon atoms or a hydrogen atom, provided that at least one of R_9 , R_{10} and R_{11} is an alkyl-, alkenyl- or acyl group, A represents an ethylene or propylene group, and e, f and g independently represent values of from 0 to 100, provided that the sum of e plus f plus d is from 50 to 300.

(3) polyoxyalkylene sorbitol alkyl- or alkenyl ethers, polyoxyalkylene sorbitol fatty acid esters represented by the following formula (VIII):



in which R_{12} through R_{17} each independently represents an alkyl-, alkenyl- or acyl group having from 10 to 24 carbon atoms or a hydrogen atom, provided that at least one of R_{12} 10 through R_{17} is an alkyl-, alkenyl- or acyl group, A represents an ethylene or propylene group, and h, i, j, k, l and m independently represent values of from 0 to 100, provided that the sum of h through m is from 50 to 300.

(4) polyoxyalkylene sorbitan alkyl- or alkenyl ethers 15 and polyoxyalkylene sorbitan fatty acid esters represented by the following formula (IX):



in which R_{18} through R_{21} each independently represents an alkyl-, alkenyl- or acyl group having from 10 to 24 carbon atoms or a hydrogen atom, provided that at least one of R_{18} 20 through R_{21} is an alkyl-, alkenyl- or acyl group, A represents an ethylene or propylene group, and n, o, p and q 25 independently represent values of from 0 to 100, provided

that the sum of n, o, p, and q is from 50 to 300.

(5) polyoxyalkylene castor oils and polyoxyalkylene hydrogenated castor oils or their derivatives with an average value of the added oxyalkylenes of from 50 to 300 moles.

The polyoxyalkylene type non-ionic surface active agents as illustrated above are characterized in that they have long chained oxyalkylene groups. A suitable number of moles of the alkylene oxide to be added, however, is in a range of from 50 to 300, preferably 70 to 200. The compound will exhibit a decreased detergency at a low concentration and tend to impair the foaming of the detergent when the number of moles of the added alkylene oxide is less than 50. On the other hand, when the number of moles of alkylene oxide is more than 300 the compound becomes unacceptably viscous.

The liquid detergent composition according to this invention is formulated with 10 to 40% by weight of the component (A), 1 to 10% by weight of the component (B) and 0.5 to 10% by weight of the component (C).

Beside these essential components, the liquid detergent composition of this invention may be added with, as an optional ingredient, a conventional low temperature stabilizer. Such a low temperature stabilizer may include lower alcohols such as ethanol and isopropanol; glycols such as ethylene glycol, polyethylene glycol, propylene glycol and polypropylene glycol; lower alkylbenzenesulfonic acids containing an alkyl group or groups of from 1 to 6 carbon atoms such as benzenesulfonic acid, p-toluenesulfonic acid

and xylenesulfonic acid; aromatic carboxylic acids such as benzoic acid and salicylic acid; and urea.

Other compounds known in the art as ingredients of a detergent may be formulated to the composition of this invention. Such compounds may include organic or inorganic builders for improving the detergency of a detergent composition, inclusive of citric acid, malic acid, gulconic acid and salts of these compounds, skin roughening preventives, enzymes, protein derivatives, opacity promoting agents, coloring agents, preservatives, perfumes and the like.

In practice, it is desirable that the liquid detergent composition of this invention have a pH of from 5 to 9, more preferably from 6 to 8.

15 The liquid composition of this invention exhibits an excellent detergency and foaming ability at a low concentration of less than 1%. Thus, the composition not only possesses a strong detergency and foaming ability which any detergent is supposed to inherently possess, but 20 also prevents washing hands from getting roughened and provides an economy because of usability at such a low concentration. Thus the composition has a wide variety of use, including particularly a detergent for washing dishes and other tablewares.

25 Other features of the invention will become apparent in the course of the following description of the exemplary embodiments which are given for illustration of the

invention and are not intended to be limiting thereof.

EXAMPLES

In the examples below properties of tested detergents were determined according to the following test methods.

5 Detergency Evaluation Test

(1) Preparation of dirt bath: A dirt bath was prepared by dissolving 20 g of a mixed oil and fat consisting of 1 part of beef tallow and 1 part of soybean oil, both meeting the specification of the Japanese 10 pharmacopoeia, and 0.1 g of oil red in 60 ml of chloroform.

(2) Preparation of stained glass plate specimens: Clean glass plates, 6 pieces for one set, were used for the test. Each glass plate was weighed precisely down to three place of decimal, dipped in the dirt bath to the depth of 55 15 mm at $25 \pm 1^\circ\text{C}$ for 1 - 2 minutes thus having stains attached thereto, and then taken out of the bath. Surplus of stains or dirt attached to the lower part of the glass plate were adsorbed by means of clean cloth like gauze or filter paper to obtain a uniform dirt on the glass plate, which was then 20 air-dried at $25 \pm 1^\circ\text{C}$ for more than 1 hour and longer than 2 hours before it was submitted to the test. At this instance the quantity of the dirt or stains on each set of 6 glass plates adjusted to 0.140 ± 0.010 g.

(3) Water

25 Water with a hardness of 3° DH (CaO/MgO molar ratio: 3/1) was employed. 59.0 mg of calcium chloride (dihydrate) and

27.2 mg of magnesium chloride (hexahydrate) each precisely weighed were dissolved in water to make the total volume to 1,000 ml.

(4) Test Procedure

5 Cleansing: One set of the stained glass plates prepared in (2) above were put into 700 ml of a 0.15% detergent solution, and washed by means of a Linnets modified detergency tester (250 $\pm$ 10 rpm) at 30 $\pm$ 1°C for a prescribed period of time.

10 Rinse: The glass plates having been cleansed as above were put into 700 ml of water prescribed in (3) above and rinsed using the Linnets modified detergency tester at 30 $\pm$ 1°C for 1 minutes.

Drying: The glass plates having been rinsed as above
15 were air-dried for overnight and submitted to the evaluation of the detergency.

(5) Detergency evaluation

The glass plate specimens were weighed to determine the proportion of removed stains or dirt (%) to make it a
20 standard of detergency evaluation.

Foaming Ability Evaluation Test

Foaming ability was measured on a 0.5% detergent solution added with 0.1% of commercially available butter, as a dirt component. Forty (40) cc of the detergent
25 solution containing butter was put in a glass cylinder with a diameter of 5 cm, agitated rotationally for 10 minutes, and then the height of the foam attained was measured immediately after terminating the agitation.

In the following description and in the Tables
following notes are applicable:

Notes:

- (i) "POE" denotes polyoxyethylene.
- 5 (ii) Values in parentheses immediately following "POE"
designate number of moles of added oxyethylene.
- (iii) Formulated quantities of each component in
Tables are expressed by weight %.
- (iv) In Table 3, "Tr" designates that the composition
is transparent, "Tu/W" designates it is turbid
10 and white, and "Tr/V" means that it is
transparent and highly viscous (3,000 cps at 20°C)

Example 1

Detergency and foaming ability were tested on various detergent compositions according to the test procedures described above. The results obtained are shown in Table 1.

5 Example 2.

Detergency and foaming ability were evaluated on the detergent compositions described below and Table 2. The results are shown in Table 2.

10 [Formulation]

	Raw Materials	Proportions (wt%)
	Sodium POE(3)* laurylsulfate	20
	Lauryldimethylamine oxide	5
15	Long chained POE* type non-ionic surface active agent (see Table 2)	0 - 8
	Ethanol	5
	Water	Balance

20 Example 3.

Detergency and foaming ability were evaluated on the detergent compositions appearing in Table 3. The appearances of the detergent compositions at normal temperature were observed. The results are shown in Table 3.

Table 1

Law Materials	Comparative Compositions					Inventive Compositions						
	1	2	3	4	5	6	7	8	9	10	11	12
Sodium POE(3) laurylether sulfate	15						15					
Sodium laurylbenzene sulfonate		15						15				
Sodium α -olefin sulfonate (Average carbon number = 14)			15						15			
Sodium alkanesulfonate (Average carbon number = 18)				15						15		
Sodium α -sulfoethyl laurate					15						15	
Sodium POE(3) laurylether acetate						15						15
Coconut oil fatty acid diethanol amide		5	3			3		5	3			3
Lauryldimethylamine oxide	3		2		3	2	3		2		3	2
Lauryl betain				7						7		
POE(100) cetylether							2	2	2	2	2	2
Ethanol	5	5	5	5	5	5	5	5	5	5	5	5
Water ("B" denotes "Balance")	B	B	B	B	B	B	B	B	B	B	B	B

Detergency Test (%)

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Foaming Ability Test (mm)

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Table 2

Long-chained POE type non-ionic surface active agent	<u>Comparative</u> <u>Composition</u>		<u>Inventive Compositions</u>								
	13	14	15	16	17	18	19	20	21		
POE(70) Laurylether	-	1	-	-	-	-	-	-	-	-	-
POE(100) Oleylether	-	-	1	-	-	-	-	-	-	-	-
POE(140) Monostearate	-	-	-	0.5	-	-	-	-	-	-	-
POE(140) Distearate	-	-	-	-	1	-	-	-	-	-	-
POE(200) Sorbitan trioleate	-	-	-	-	-	2	-	-	-	-	-
POE(100) Glycerol monostearate	-	-	-	-	-	-	5	-	-	-	-
POE(200) Sorbitol tetraoleate	-	-	-	-	-	-	-	8	-	-	-
POE(280) Hydrogenated castor oil	-	-	-	-	-	-	-	-	-	5	-
Detergency Test (%)	58	80	82	88	91	86	85	85	79		
Foaming Ability (mm) Test	95	95	97	95	95	96	95	93	95		

Obviously, numerous modifications and variations of the present invention are possible in light of the above teachings. It is therefore to be understood that the scope of the appended claims, the invention may be practiced
5 otherwise than as specifically described herein.



CLAIMS

1. A liquid detergent composition comprising:

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(A) from 10 to 40% by weight of a synthesized anionic surface active agent,

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(B) from 1 to 10% by weight of a nitrogen-containing amphoteric or non-ionic surface active agent, and

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(C) from 0.5 to 10% by weight of a nitrogen-free polyoxyalkylene addition type non-ionic surface active agent having from 50 to 300 oxyalkylene groups per molecule;

wherein said component (C) comprises at least one compound selected from the following:-

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(i) a polyoxyalkylene alkyl- or alkenyl ether, or polyoxyalkylene fatty acid ester represented by the following formula (VI):-



- 19 -



5 in which R_7 represents an alkyl-, alkenyl- or acyl group having from 10 to 24 carbons, R_8 represents an alkyl, alkenyl- or acyl group having from 10 to 24 carbons or a hydrogen atom, A represents an ethylene or propylene group, and d is a value of from 50 - 135 or 137-300;

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(ii) a polyoxyalkylene glycerol alkyl- or alkenyl-ether;

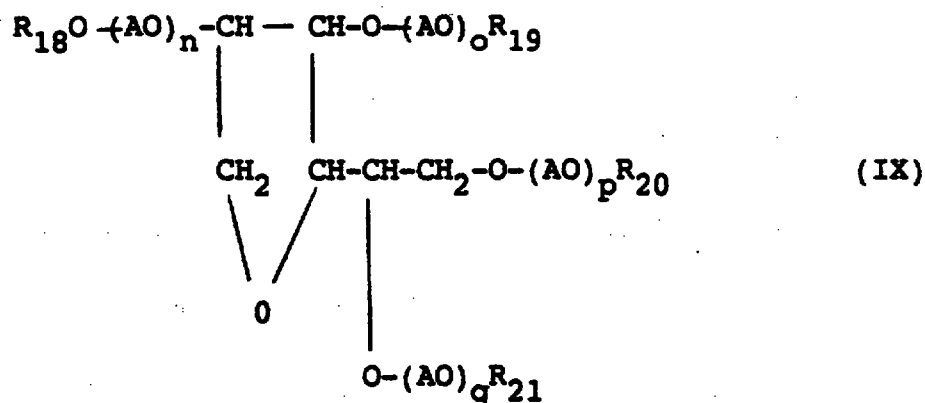
(iii) a polyoxyalkylene glycerol fatty acid ester;

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(iv) a polyoxyalkylene sorbitan alkyl- or alkenyl ether, or a polyoxyalkylene sorbitan fatty acid ester represented by the following formula (IX):



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in which each of R_{18} , R_{19} , R_{20} and R_{21} independently represents an alkyl-, alkenyl- or acyl group having from 10 to 24 carbon atoms or a hydrogen atom, provided that at least one of R_{18} , R_{19} , R_{20} and R_{21} is an alkyl, alkenyl or acyl group, A represents an ethylene or propylene group, and each of n , o , p and q independently represents a value of from 0 to 100, provided that the sum of n , o , p , and q is from 50 to 300.

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(v) a polyoxyalkylene sorbitol alkyl- or alkenyl ether;

(vi) a polyoxyalkylene sorbitol fatty acid ester; or



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(vii) a polyoxyalkylene castor oil or a polyoxyalkylene hydrogenated castor oil.

5 2. A liquid detergent composition according to claim 1, wherein said component (A) is selected from polyoxyethylene alkyl- or alkenyl ether sulfates, alkylbenzenesulfonates, polyoxyethylene alkyl- or alkenyl ether acetates, α -olefin sulfonates, alkane sulphonates, salts of α -sulfofatty acid esters.

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3. A liquid detergent composition according to claim 1 or claim 2, wherein said component (A) is selected from polyoxyethylene alkyl- or alkenyl ether sulfates, or alkylbenzenesulfonates.

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4. A liquid detergent composition according to claim 1, wherein said component (B) is selected from mono long chained alkyl- or alkenyl tert-amine oxides, or higher fatty acid alkanol amides or ethylene oxide adducts thereof.

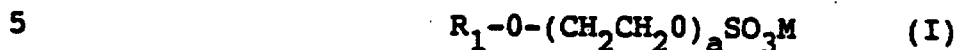
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5. A liquid detergent composition as claimed in claim 3, wherein said component (A) is a



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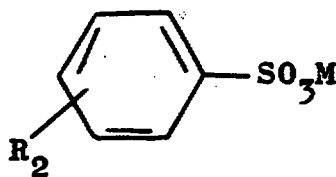
polyoxyethylene alkyl- or alkenyl ether sulfate
represented by the following formula (I):



in which R_1 represents an alkyl- or alkenyl group
having from 10 to 24 carbon atoms, a is a value of
from 1 to 5, M represents an alkali metal, ammonium or
10 an alkanolamine group.

6. A liquid detergent composition as claimed in
claim 3 wherein component (A) is an
alkylbenzenesulfonate represented by the following
15 formula (II):

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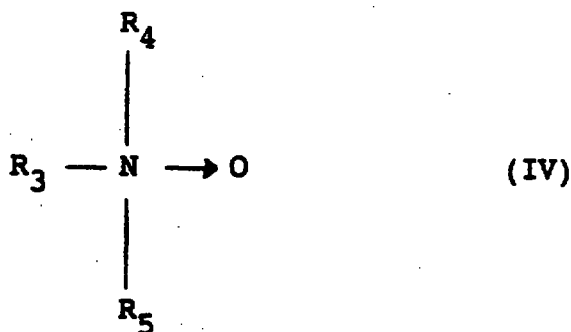
(II)



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in which R_2 represents an alkyl group having from 8 to 20 carbon atoms and M represents an alkali metal, ammonium or alkanolamine group.

- 5 7. A liquid detergent composition as claimed in claim 4 wherein component (B) is a mono long chained alkyl- or alkenyl tert-amine oxide as represented by the following formula (IV):



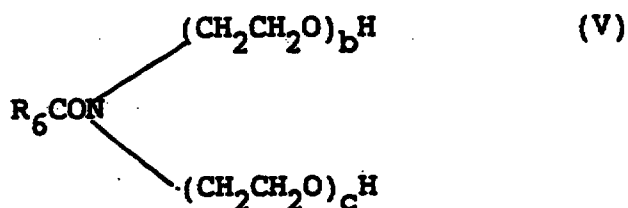
20 in which R_3 represents an alkyl- or alkenyl group having from 10 to 18 carbon atoms, and R_4 and R_5 independently represent alkyl groups having 1 or 2 carbon atoms.



- 24 -

8. A liquid detergent composition as claimed in claim 4 wherein component (B) is a higher fatty acid alkanol amine or ethylene oxide adduct thereof represented by the following formula (V):

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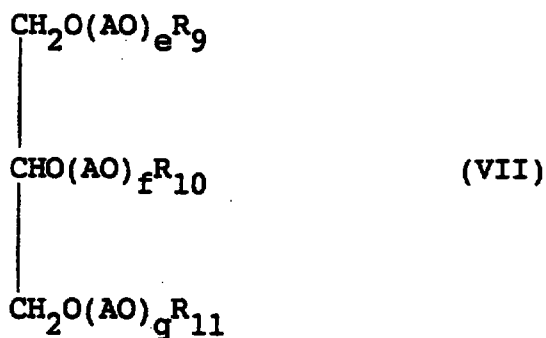


10 in which R_6 represents an alkyl- or alkenyl group having from 10 to 18 carbon atoms, b is a value of from 1 to 3 and c is a value of from 0 to 3.

15 9. A liquid detergent composition as claimed in claim 1, wherein component (C) comprises a polyoxyalkylene glycerol alkyl- or alkenyl ether, or a polyoxyalkylene glycerol fatty acid ester represented by the following formula (VII):



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in which R_9 , R_{10} and R_{11} , each independently represents an alkyl-, alkenyl- or acyl group having from 10 to 24 carbon atoms or a hydrogen atom, provided that at least one of R_9 , R_{10} and R_{11} is an alkyl-, alkenyl- or acyl group, A represents an ethylene or propylene group, and e, f and g independently represent values of from 0 to 100, provided that the sum of e plus f plus d is from 50 to 300.

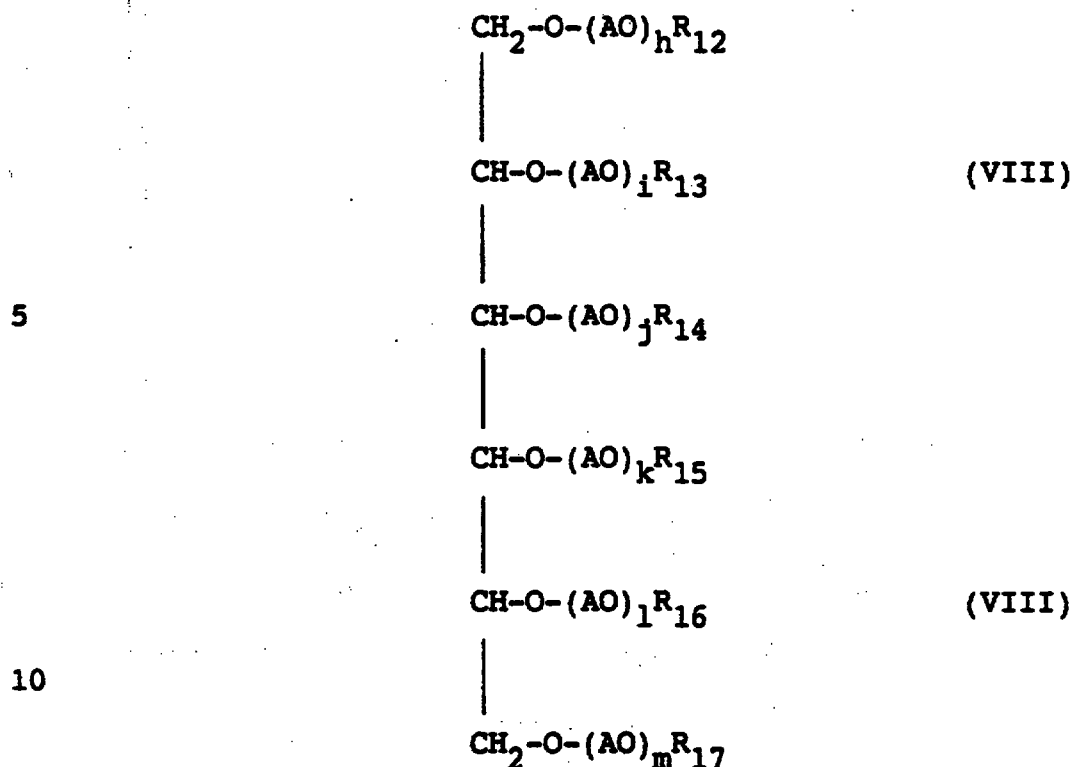
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10. A liquid detergent composition as claimed in claim 1 wherein component (C) comprises a polyoxyalkylene sorbitol alkyl- or alkenyl ether, or a polyoxyalkylene sorbitol fatty acid esters represented by the following formula (VIII):



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in which R_{12} through R_{17} each independently represents an alkyl-, alkenyl- or acyl group having from 10 to 24 carbon atoms or a hydrogen atom, provided that at least one of R_{12} through R_{17} is an alkyl-, alkenyl- or acyl group, A represents an ethylene or propylene group, and h, i, j, k, l and m independently represent values of from 0 to 100, provided that the sum of h

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through m is from 50 to 300.



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11. A liquid detergent composition as claimed in any one of the preceding claims wherein the nitrogen - free polyoxylalkylene addition type non-ionic surface active agent comprises from 70 to 200 oxyalkylene groups per molecule.

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12. A liquid detergent composition, as claimed in any one of the preceding claims, having a pH of from 5 to 9 and, preferably, from 6 to 8.

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13. A liquid detergent composition substantially as hereinbefore described. (
